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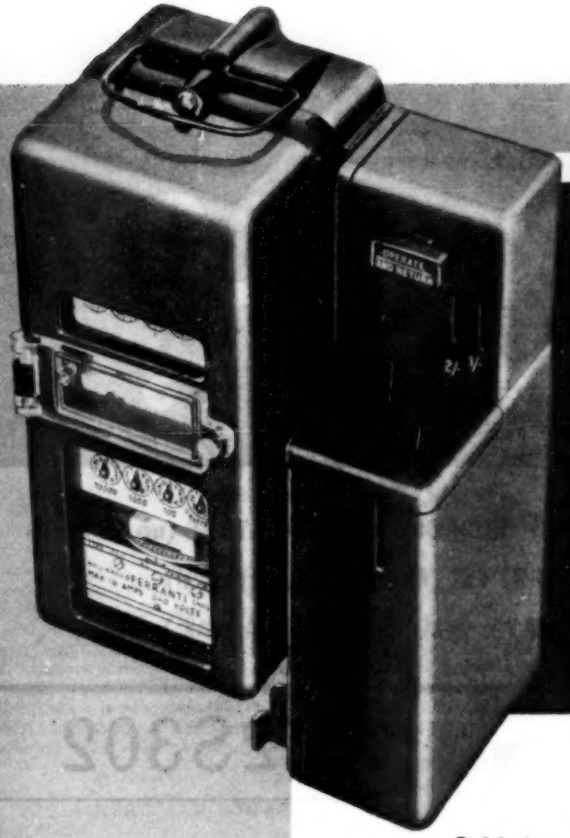

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ELECTRICAL ENGINEERING ABSTRACTS

Volume 63 DECEMBER 1960 Number 756

GENERAL

(For abstracts on circuit theory see also Lines . Networks . Filters)

614.825

7061 RESUSCITATION OF ELECTRIC-SHOCK VICTIMS. H.Fischer.

Bull. Assoc. Suisse Elect., Vol. 51, No. 15, 751-6 (July 30, 1960). In French.

Existing methods are reviewed and some new methods discussed. The physiological action is given in some detail for various cases. For l.v. accidents immediate application of artificial respiration is called for and the Holger–Nielsen method is recommended, preferably with artificial insufflation of the lungs. Some drugs which may be injected beneficially are listed. In extreme cases manual heart massage is called for. With h.v. accidents ventricular fibrillation is common; insufflation is recommended, with Holger–Nielsen respiration. Rocking methods are recommended where practicable. The administration of bicarbonate of soda immediately is of value.

E.H.W.Banner

614.825 : 621.316.5

7062 THE INTRINSICALLY SAFE METHOD OF PROTECTION. H.Siems.

Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 12, 431-4 (June 6, 1960). In German.

Many factors must be considered when a piece of equipment is to be tested for intrinsical safety. There is considerable divergence between the various sources of information concerning the relative amount of gas needed to produce an explosive mixture. The different factors influencing the liability of a given gas–air mixture to explode are discussed. The gases mainly coming under consideration are hydrogen, methane and town gas. When selecting a gas for test purposes, it is not necessarily correct to choose the gas which will be present at sight. The choice of spark-forming contact electrodes is also important and it has been demonstrated that the influence of their material composition is greater than that of their shape.

A.S.Hay

621.3

7063 DIFFERENCE EQUATIONS AND THEIR APPLICATIONS. L.A.Pipes.

Trans Amer. Inst. Elect. Engrs I, Vol. 79, 333-9 (1960) = Commun. and Electronics, No. 49 (July, 1960).

An introduction for engineers describes the nature of the calculus of finite differences and defines the basic operators used. The solution of linear difference equations with constant coefficients is derived and applied to the analysis of a circuit containing n filter networks in cascade and to a problem involving the oscillation of a long train made up of a chain of identical coaches. Methods of solving ordinary and partial differential equations approximately by difference methods when they cannot be solved by ordinary methods are also given.

G.A.Montgomerie

621.3.01

7064 ON A SYSTEMATIC APPROXIMATION TO THE PARTITION METHOD FOR ANALYSIS OF A CLASS OF NONLINEAR SYSTEMS. Y.H.Ku, A.A.Wolf and J.H.Dietz.

Trans Amer. Inst. Elect. Engrs II, Vol. 79, 183-91 (1960) = Applic. and Industr. No. 49 (July, 1960).

The dynamic behaviour of a broad class of physical systems can be described by a set of equations which possesses a unique solution. Wolf (Abstr. 4162 of 1960) devised a general partition method of analysis which yields the exact solution as a power series with recursively related coefficients. The method may be laborious when applied to the calculation of numerical solutions. In this paper the partition concept is extended so that the computational labour depends only on the desired accuracy. In this case the non-linear terms give rise to numerical values rather than to multifold convolution sums involving coefficients of a power series. Expressions are also derived for estimating the error in the approximate solution.

S.C.Dunn

621.3.011

7065 THE NUMBER OF MUTUALLY INDEPENDENT QUANTITIES WHICH ARISE IN ELECTRICAL THEORY. J.Fischer.

Arch. Elektrotech. (Berlin), Vol. 45, No. 2, 77-98 (1960). In German.

The number of independent quantities used depends whether definitions are based on experimental laws or are purely empirical. A detailed discussion is given of various systems, for example those based on "mechanical" quantities such as mass, length and time and those based on concepts such as unit charge and unit magnetic pole.

V.G.Welsby

621.3.011

7066 DEVELOPMENT TRENDS IN MODERN OPERATIONAL CALCULUS. F.H.Lange.

Hochfrequenztech. v. Elekt.Akust., Vol. 69, No. 2, 67-75 (April, 1960). In German.

A review paper. It is pointed out that in addition to the usual way of regarding the operational calculus as descended from the empirical work of Heaviside, there are now three other ways of regarding it. These involve, respectively, the process of convolution, an extension of the Duhamel integral and a variation on the Carson–Laplace integral. The various representations are compared in a series of tables and it is suggested that, in future, work on parametric resonance may select one of these forms as being the more useful.

S.C.Dunn

621.3.011

7067 REMARKS ON THE TENSOR FORM OF MAXWELL'S EQUATIONS. M.Julier.

Onde Elect., Vol. 40, 260-2 (March, 1960). In French.

Various supplementary terms have been added to Maxwell's equations in the ordinary form to account for low temperature or nuclear phenomena etc. It is shown how the tensor form of the classical equations may be modified so as to be able to write

$\nabla_\mu F'^{\lambda\mu} = J'^{\lambda}$ (instead of = 0) in analogy with the familiar

$\nabla_\mu F^{\lambda\mu} = J^{\lambda}$ ($F^{\lambda\mu}$ is the antisymmetric electromagnetic field tensor)

Just as vector J, proportional to the velocity vector, represents an electric current, J' will represent a magnetic current if proportional to the velocity vector. Other interpretations are possible for J' when it is not proportional to the velocity vector.

D.E.Brown

621.3.011.1

7068 LINEARIZATION OF STATIC CIRCUIT CHARACTERISTICS BY MEANS OF INVERSE FUNCTION. K.Jankowski.

Arch. elektrotech. (Warsaw), Vol. 8, No. 3, 389-402 (1959). In Polish.

The design of a circuit giving the desired transfer characteristic is considered. To obtain this function the parameters of the circuit are considered as dependent on some auxiliary parameter (e.g. the shape etc. of a coil.). This dependence gives the key to the design operation. These parameters may be designed to give the inverse of a given transfer function and so linearize the system. The method is applicable to static conditions only, when the transfer function may be assumed to have fixed numerical values.

T.Horrocks

621.3.011.2

7069 CALCULATIONS BY MEANS OF THE RECTANGULAR IMPEDANCE CHART. J.Čajka.
Slaboproudý Obzor, Vol. 21, No. 6, 340-5 (1960). In Czech.

The rectangular impedance chart was introduced by Megla (Dezimeterwellentechnik, Leipzig: Fachbuchverlag 1953). This device has certain advantages as compared with the Smith chart. The method of constructing the chart and some of its applications are discussed. It is shown that in the rectangular chart, the loci of constant impedance, constant standing-wave ratio, attenuation and modulus of the reflection coefficient are represented by circles, while the locus of the constant phase angle is a straight line. The method of transforming the impedances by a transmission line of length l is indicated. The calculation of the reciprocals of impedances by means of the chart is explained. The chart is also used in the solving of the following problems: determination of the load from the measured standing-wave ratio and the position of the first minimum, and matching of the load to the line by means of one or two shorted stubs. R.S.Sidorowicz

621.3.011.23

7070 CALCULATION OF CURRENT IN A RL CIRCUIT WITH HALF-WAVE RECTIFICATION.
A.I.Glukharev, L.A.Foigel' and N.B.Gel'man.
Elektrichestvo, 1960, No. 5, 58-60 (May). In Russian.

The mean value of half-wave rectified current is found by graphical integration, and plotted as a function of $K = \omega L/R$. A simple analytical expression is then found closely following the obtained curve. Agreement was checked experimentally over the range $0 < K < 10$. Practical applications are briefly suggested. A.K.Podkolinski

621.3.011.24

7071 THE SPECIFICATION OF ANY REQUIRED BOUNDARY CONDITIONS OF THE FIRST KIND WHEN SHAPING A FIELD BY THE INDUCED CURRENT METHOD.
G.M.Gershtein and A.V.Khokhlov.
Zh. tekh. Fiz., Vol. 30, No. 5, 480-90 (May, 1960). In Russian.

Develops the ideas of Gershtein, Izv. Vuzov [Radiofizika, 2, No. 4, 602 (1959)]. The field at a point of the interelectrode space is regarded as the result of superimposing the partial fields obtained by assigning in turn a potential $\Psi = 1$ to each electrode, the potential of the rest being meantime $\Psi = 0$. This idea is developed via the Shockley–Ramo theorem (Abstr. 2525 of 1939) and a circuit worked out whereby any boundary conditions can be assigned. The results are applied to a cylindrical segmental structure and a rod structure. Experimental results are discussed for: (a) a structure with 24 segments of internal diameter 72 mm, length 70 mm, width 10 mm, and a slot width of 1 mm, with thin polystyrene probe rotating at 300 rev/min; (b) a structure of internal diameter 40 mm with 8 rods of diameter 8 mm and length 65 mm, and the probe rotating at 2000–3000 rev/min. D.E.Brown

621.3.011.3

7072 CONTRIBUTION TO THE ANALYSIS OF THE PHENOMENON OF SURGE SKIN-EFFECT. J.Hryhczuk.
Arch. elektrotech. (Warsaw), Vol. 8, No. 3, 521-6 (1959). In Polish.

The distribution of the current density is examined in a conductor of circular cross-section subjected to current surges of arbitrary shapes. Exact formulae are obtained for the electric and the magnetic field intensities in a transient state. Z.F.Voyner

621.3.012

7073 GRAPHICAL EXTENSION OF TRANSFORM TECHNIQUES. R.S.Smith.
Electronics, Vol. 33, No. 14, 68-71 (April 1, 1960).

A geometrical interpretation of the idea of convolution is given and it is shown how problems involving multiplication in the time domain may be resolved by convolution in the frequency domain. For many of the functions commonly encountered the integration required may be carried out by inspection. Two examples are given of the technique, in the first one the effect of aerial scan modulation in spreading out the frequency spectrum of the return from target is examined and it is shown how spreading is inversely proportional to the hits-per-beamwidth on target. The second example involves placing a notch filter with a Q of 500,000 in a passband of an i.f. amplifier. The circuit involves conventional quadrature detection techniques, but the step-by-step graphical analysis enables the effects of unequal channel gain, non-orthogonal phase-shifts and other non-ideal circuit conditions to be investigated S.C.Dunn

621.3.012.1

7074 CONTRIBUTION TO THE COMPLEX TREATMENT OF A.C. VOLT-AMPERE. H.Wagner von Wagenried.
Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 15, 528-30 (July 18, 1960). In German.

A simple presentation of VA as a vector quantity. Examples explain the application of the method. P.Linton

621.3.012.1

7075 THE COMPLEX PRESENTATION OF VOLT-AMPERE IN A.C. CIRCUITS. A.Hochrainer.
Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 15, 531-2 (July 18, 1960). In German.

A strict derivation of the complex presentation of VA and its application to Kirchoff's laws on mesh systems. P.Linton

621.3.013

7076 MAGNETIC MOMENTUM AND MAGNETIC CHARGE. J.Fischer.
Arch. Elektrotech. (Berlin), Vol. 45, No. 3, 157-61 (1960). In German.

There exist in general two definitions of magnetic moment and magnetic charge. A discussion as to the origin of the two definitions and their validity is given. After an introduction to the meaning of charge in the electrical field it is proved, using the general magnetic laws, that the definitions of magnetic charge and moment should be related to the magnetic fieldstrength H, rather than to the magnetic induction B. E.Maanders

621.3.013.2

7077 DETERMINATION OF ERRORS AND RANGES OF APPLICATION OF FORMULAE FOR SPECIFIC MAGNETIC PERMEANCE. B.K.Bul'.
Elektrichestvo, 1960, No. 4, 51-7 (April). In Russian.

Formulae are proposed by various authors for calculating magnetic permeance in the side regions of the pole pieces near the air gap are tabulated and numerical values obtained by their application are represented by curves. Magnetic flux was measured along a round pole-piece, and results of measurements are compared with theoretical data. Side permeances depend on the ratio of the pole diameter and the length of the air gap. None of the proposed formulae give satisfactory results over the whole investigated range of the distances from the air gap, ratios of these distances and lengths of the air gap, and ratios of pole-piece diameters and air-gap lengths. Curves of side permeances for round pole-pieces, computed from experimental data, are given. Similar analysis is performed for rectangular pole-pieces. Limits of applicability of various existing formulae, with errors not exceeding 15%, are given in a table. J.M.Silberstein

621.3.013.2

7078 THE MAGNETIZATION OF LONG CYLINDERS IN WEAK CONSTANT FIELDS. G.Grinberg.
Latv. PSR Zinat. Akad. Vestis, No. 2 (151), 73-7 (1960). In Russian.

It is shown that it is most convenient in calculating the field within a long magnetic rod to use a variable which is the length variable referred to the radius. It is also necessary to take account of the permeability of the material. It is shown that for long cylinders, the field distribution depends much more on the permeability than on the position at which the field is measured. The distributions which are derived are in terms of two special functions which are given. S.C.Dunn

621.3.013.23

7079 MAGNETIC FIELD OF A DIRECT CURRENT IN A PARALLELEPIPED. V.N.Rudakov.
Elektrichestvo, 1960, No. 7, 39-41 (July). In Russian.

The surface level of molten aluminium in an electrolytic furnace is distorted and the output of the process is lowered by the presence of a magnetic field induced by the electrode current. The field due to a rectangular bar-shaped anode is calculated for any point in its vicinity (or inside it) in terms of a series of functions of the type

$$\phi(X,Y) = X \ln\frac{R+1}{R-1} + \ln\frac{R+X}{R-X} - Y \arcsin\frac{2RXY}{(R^2-1)(R^2-X^2)}$$

where $R^2 = X^2 + Y^2 + 1$. A family of graphs of the function is given. Z.A.A.Krajewski

621.3.017.71

7080 A NEW METHOD OF MEASUREMENT AND EVALUATION OF HEATING CURVES. E.Stumpp.
Elektrie, Vol. 14, No. 7, 237-8 (July, 1960). In German.

Describes how heating curves can be deduced and evaluated from a new form of measurements. The basis of the method is explained and takes account of the variations in conductor resistance due to rise in temperature and skin effect. J.T.Hayden

POWER RESOURCES
PRIME MOVERS

620.9

7081 SOME PROBLEMS AND RESULTS CONCERNING THE SUPPLY AND UTILISATION OF FUEL FOR DANISH POWER STATIONS. H.Weldingh.
World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper $IIA_1/3$, 20 pp.

Denmark's requirements for electric power are predominantly covered by imported fuels. There are half a score of thermal power stations of a size of 100 MW and over, covering between them more than 96% of the country's aggregate electricity consumption, which in 1956 amounted to well over 4100 GWh. Some of these power stations also supply district heating. Apart from periods when, owing to the war, sufficient fuel could not be procured from abroad, the stations have pursued the policy of using the fuel which gives the lowest total energy cost. The aim has therefore been to be able to use fuel from many different countries and collieries and of varying properties, ranging from ordinary coal, such as smalls and duff coal, to slurry, silt and coke breeze, and — for stations in certain parts of the country — brown coal and peat. Developments have caused the stations to shift gradually to the use of lower-grade fuel, in consequence of which the annual average calorific value in the course of 20 years has decreased from about 6700 kcal/kg to about 3700 kcal/kg. At the same time, the average thermal efficiency for electricity generation has risen from about 20% to about 26%. On the biggest boilers, pulverized fuel firing is used in combination with oil burners. A few of the most recent pulverized fuel plants are designed for burning brown coal as well; but so far, no actual experiences are available for publication to illustrate whether these boilers can cope with as wide a range of fuels as spreader stoker boilers, and whether the higher initial cost is justifiable. The stations which, during the last few years, have switched over to burning chiefly brown coal have so far been stations with stoker-fired boilers. The transition to brown coal has caused increased content of sulphurous gases and fly ash in the flue gas. In several cases, conditions have been improved by taller stacks, and the mechanical ash collectors have now, in a few cases, been supplemented by electrostatic collectors.

620.9

7082 WATER SUPPLY AND HYDRAULICITY. W.Leitner.
Elektrizitätswirtschaft, Vol. 59, No. 13, 419-21 (July 5, 1960).

The hydraulic index or "hydraulicity" is explained and its dependence on river flow and the probability of its variation from the mean is discussed. Questions concerning the correct definition are raised, including storage reservoirs and the effect of river improvement. P.Linton

620.92

7083 SURVEY OF POTENTIAL HYDRO POWER IN JAPAN. K.Shinohara.
World Pwr Conf. Sectional Meeting (Madrid, 1960), Paper $IA_2 6$, 8 pp.

Deals in general with the survey of potential hydro-power in Japan and in particular with the Fourth Survey of Potential Hydro Power Resources which is being conducted under a 4-year programme beginning in 1956 and ending in 1959. The methods of survey, criteria for determining potential hydro power and method of evaluating economic feasibility are covered.

620.92

7084 RAINMAKING AND PREVENTION OF EVAPORATION AS MEANS OF INCREASING THE WATER RESOURCES OF AUSTRALIA. F.W.G.White.
World Pwr Conf. Sectional Meeting (Madrid, 1960), Paper $IA_2 7$, 10 pp.

Over most of Australia the rainfall is low and variable, and the possibilities for developing irrigation and hydroelectric schemes are limited. The Commonwealth Scientific and Industrial Research Organization has therefore undertaken an intensive programme of research on the artificial stimulation of rain. Seeding experiments have been carried out both on single clouds and over large areas. In an experiment on the seeding of a mountain catchment area, extending over four years, significant increases in precipitation have been observed. As the normal annual evaporation over most of Australia is high, methods for reducing evaporation have also been investigated by C.S.I.R.O. It has been shown that monomolecular surface films of hexadecanol can reduce evaporation considerably, and practical methods for maintaining films have been developed.

620.92

7085 A PROBABILIST METHOD FOR STUDY OF INTERANNUAL RIVER REGULATION. E.Becerril.
World Pwr Conf. Sectional Meeting (Madrid, 1960), Paper $IA_2/9$, 14 pp. In Spanish.

A distinction is drawn between annual and interannual regulation: the first is regarded as referring to the adaptation of the river's flow regime, within each annual cycle, to the shape of the consumption curve, whereas interannual adaptation should proceed from the volumes required to supplement the flow in dry years. Hence, for the study of annual regulation, the paper admits those methods which presuppose a more or less exact determination of the shape of the flow curve, whereas for interannual regulation, barring evidence to the contrary, it is thought better to resort to probability calculations and to regard the river as solely governed by a statistical function which is its frequency curve. On this assumption, the paper states the possibility of obtaining long-term statistical series by drawing lots, and works out an analytical method for drawing n diagrams, n being the number of years regarded as grouped together in interannual exploitations and Δ the maximum probably accumulated deviation. If, moreover, the exploitation is carried out with a regime which represents a fraction r of the mean flow for a century or modulus, the diagram itself gives the accumulated deviations Δ_r corresponding to the probability p between the service regime and the flow of the river, i.e. the reservoir volume that must be provided for guarantee $G = 1 - p$ so as to maintain the integrity of the regime r. Stress is laid on the importance of the idea of guarantee and the meaning of the regulation index $I = Gr$ which remains practically constant in every development. The method is developed by using disymmetrical exponential functions which allow the general tracing of the diagram $n\Delta$ and consequently the construction of an abacus which directly gives the reservoir volume given the characteristic of the river (fluvial index), the regime of demand and the guarantee required.

621.039

7086 THE PROSPECTS FOR NUCLEAR POWER IN THE PHILIPPINES.
P.G.Afable, C.P.Nuguid and M.R.Eugenio.
World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper IVA/3, 14 pp.

Presents a brief summary of the power situation in the Philippines, and the possible application of nuclear energy thereto. As of October 1959, the Philippines has a total generating capacity of 431 MW (electrical). Of this total, hydroelectric power plants account for 186 MW; thermal (oil-fired) steam plants, 175 MW; and diesel plants, 70 MW. It is estimated that Luzon will need a total installed capacity of 1000 MW by 1968. By that time, it is anticipated that there will be a need to put up a 100 or 150 MW thermal plant. Operating conditons in the Manila area are highly favourable for base load operation which is ideally suited to nuclear power plants. If nuclear power proves to be economically competitive by that time (11 mills per kWh), such a thermal plant could possibly be nuclear-powered. Current cost estimates seem to indicate that this figure will be attained within the next 10 years.

621.224

7087 POWER MEASUREMENT AND EFFICIENCY DETERMINATION ON WATER TURBINES. G.Hutarew.
Elektrizitätswirtschaft., Vol. 59, No. 13, 440-6 (July 5, 1960). In German.

Summarizes the provisions of the new I.E.C. turbine test code,

with special reference to the accuracy of flow and head measurement. The discussion contains practical details of efficiency measurements on hydroelectric alternators and proposals for new methods. P.Linton

621.224

7088 A COMPARATIVE STUDY OF THE KAPLAN AND DÉRIAZ TURBINES. P.Dériaz.

Houille blanche, Vol. 15, No. 4, 331-43 (June, 1960). In French.

A brief historical review of the developments of the Dériaz turbine and its applications, including several sectional drawings. A comparison with the Kaplan turbine as regards hydraulic and mechanical considerations. The advantages of the Dériaz type in many respects are pointed out. Comparative tests on a model turbine fitted with the 2 runners are described. A short bibliography is added. R.G.Jakeman

621.224

7089 GOVERNING OF WATER TURBINES. G.J.Causon.

Instn Engrs Austral., elect. mech. Engng Trans, Vol. EM1, No. 2, 45-57 (Nov., 1959).

The paper is primarily concerned with the practical aspects of governing. A method of determining governor performance is given together with approximate methods of selecting the important governor settings which determine the stability and "quality" of governing. Methods of determining the system "self-regulation" are given. Methods of system frequency-regulation are discussed.

629.13.035 : 621.317.1

7090 INSTRUMENTATION FOR PLASMA PROPULSION. J.J.Pearson.

Electronics, Vol. 33, No. 24, 66-9 (June, 1960).

Describes a plasma propulsion system and gives a brief qualitative discussion of the ancillary apparatus and instrumentation necessary for its investigation. Instrumentation is required to determine the mass of the efflux together with its temperature, ionization, density distribution etc. Much of the article is concerned with the description of a streak photography system used to photograph the progressive formation of the pinch in the plasma jet. G.D.Sims

POWER SUPPLY
POWER STATIONS

621.311 : 657.372.3

7091 A GENERAL THEORY OF DEPRECIATION OF ENGINEERING PLANT. D.Rudd.

Proc. Instn Elect. Engrs, Paper 3366 S, publ. Nov., 1960, 10 pp. To be republished in Vol. 108 A (1961).

The conventional methods of providing for the depreciation of engineering plant are criticized on the grounds that they contain arbitrary features, and a general theory is formulated which is not subject to such criticism. The general theory is applied first to individual projects, showing how the factors which affect depreciation operate, and secondly to an integrated industry, showing how the programmes for writing off the investments in the industry can be coordinated and the economic assessment of new projects facilitated in consequence. The effects of variations in the value of money are also considered. The propositions are illustrated by numerical examples drawn, in the case of the application to an integrated industry, from the field of public electricity supply.

621.311.1

7092 OPERATIONS RESEARCH STUDY OF PEAKING POWER ECONOMICS J.K.Dillard.

World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper $\Pi A_1/6$, 23 pp.

The new types of generation embody the peaking power concept — the idea of low capital-cost units specifically designed to carry the system peaks with some sacrifice in efficiency. The use of special peaking units may reduce revenue requirements or improve profits on certain systems, depending on load patterns, fuel cost, and extent of application. The new tools of analysis include modern high-speed electronic computers, the availability of which encourages the use of the scientific method in analysing the economic problem of peaking. A comprehensive analysis of peaking economics with due consideration of many of the variables is given. Included are the effects of load pattern changes, variations in peaking capacity installed, types of peaking units, fuel cost changes, and rate of load growth. Production cost increases caused by peaking plants are presented as $/kW that must be saved in peaking-unit capital cost to break even. The amount of peaking capacity needed is then optimized. While the study is for a particular system, cost structures have been generalized. Thus the areas of application for new peaking-power sources are broadly defined.

621.311.1

7093 METHODS FOR THE STUDY OF ELECTRIC POWER NETWORKS. P.Gaussens.

Rev. gen. Elect., Vol. 69, No. 7, 375-8 (July, 1960). In French.

In the planning of transmission networks it is necessary to establish the optimum solution in respect of the total of all factors describing the nature and the number of installations, their characteristics and the structure of the entire system. It is shown by a technical–economic analysis that a single criterion for such an optimum solution can be established by a set of rules, leading, however, to a number of possibilities as regards the topology of a transmission system. It is also shown that this multiplicity can be reduced by modern calculating methods to a smaller figure. Although any single system topology still allows of several different technical designs, this number may be reduced by optimization. The whole procedure is described in detail. H.Norel

621.311.1

7094 PRODUCTION AND DISTRIBUTION OF ELECTRIC ENERGY. F.Y.Moreno.

An. Mecan. Elect., Vol. 36, No. 4, 321-52 (Nov.-Dec., 1959). In Spanish.

A detailed illustrated report about the development of electric energy in Spain within the last 50 years and particularly during the last two decades. A great number of graphs shows this development and particularly the influence of the Spanish civil war and the second world war which caused marked restrictions in the delivery of the necessary machinery, in particular between 1944 and 1954 and thus a discrepancy between energy demand and available plant. A comparative graph shows the development in Spain and other countries. A number of photographs show typical hydroelectric and thermal power stations the locations of which are indicated on a map. The question of tariffs and their unification by OFILE (Oficina Liquidadora de Energia Electrica) is dealt with at some length. R.Neumann

621.311.1

7095 PRODUCTION AND TRANSMISSION OF ENERGY IN FINLAND. G.Boll.

Elektrotech. Z.(E.T.Z.) A, Vol. 81, No. 9, 341-4 (April 25, 1960). In German.

Following a short review on hydro-electric developments and other sources, problems arising in connection with energy transmission over high-voltage lines (400 kV) are indicated. Details are tabulated and described for masts and insulators, building materials, line materials and design stresses. Reference is made to the power interchange system, present and future, between Finland and the Scandinavian countries. 4 references. A.Reiss

621.311.1

7096 GENERATION AND CONSUMPTION OF ELECTRICAL ENERGY IN SWEDEN IN 1959. F.Paszkowski.

Svenska Vattenkr Fören. Publ. Medd. No. 162, (1960: No. 10), 131-4. In Swedish.

A statistical survey. The total generated energy amounted to 32556 GWh, a 6% rise over the previous year. Of this total 90% was hydro-electric generation, 10% thermal, and 330 GWh were imported. The thermal contribution was twice that of 1958 owing to the exceptional water shortage in the summer. Exported energy was 552 GWh, the highest quantity ever. There was 7% increase in installed prime movers in 1959. Industry absorbed 64% of the generated energy, private consumers 27%. G.N.J.Beck

621.311.1 : 681.142

7097 PRODUCTION COST CALCULATIONS FOR SYSTEM PLANNING BY OPERATIONAL GAMING MODELS. K.M.Dale, W.H.Ferguson, C.H.Hoffman and J.A.Rose.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1746-52 (1960) = Pwr Apparatus Syst., No. 46 (Feb., 1960).

See Abstr. 3941 of 1960. A high accuracy method of electrical energy production cost calculation makes possible the evaluation by an electronic computor of small differences between nearly equal alternative plans. It takes account of spinning-reserve policies, pumped-storage hydroelectric units, and partial load operation.

G.A.Montgomerie

621.311.1

7098 THE POWER SITUATION IN CHILE.
R.E.Salazar and A.Bennett.
Water Pwr, Vol. 12, No. 10, 375-80 (Oct., 1960).

Presents a picture of the present power situation in Chile and outlines the overall plan for development up to 1972, with special reference to the work of ENDESA.

621.311.1

7099 LATEST ACHIEVEMENTS IN ITALY IN CONNECTION WITH THE HIGH-EFFICIENCY USE OF FUEL FOR GENERATION OF ELECTRIC POWER.
F.Roma, F.Castelli and L.Chiappa.
World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper $IIA_3/2$ 12 pp.

Appraises the present state of the technique in Italy in the particular branch of electric power generation by means of conventional fuels. Reviews the characteristics of the large Italian steam power stations, with particular mention of some of them which have a higher capacity and still higher steam conditions, and of some others which have been built in the close vicinity of mines in order to make use of very low-grade brown coal. After a brief mention of stand-by and peak-load stations with gas turbine generators, the paper devotes special attention to stations built close to industrial factories for the purpose of generating both steam and electric power, and gives data and characteristics of the highest capacity plants of this kind, either recently installed or still under construction.

621.311.1

7100 THE DEVELOPMENT OF LARGE ELECTRICITY GENERATING UNITS. E.S.Booth and J.W.H.Dore.
World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper $IIA_1/7$, 21 pp.

Describes the latest developments in the design of power plant in Great Britain for the Central Electricity Generating Board. These have been characterized by a greater emphasis on increasing the size of generating units rather than on increasing the steam conditions. Data made available by the purchase of some 13 000 MW of plant over a period of ten years suggest that where ratings are increased by natural evolutionary development, doubling the unit rating results in a reduction of the order of 20% of the overall cost per kW of the installations, and that the combination of technological advances and improvements in manufacturing efficiency have resulted in real costs reducing at a rate of $2\frac{1}{2}$% per annum. Improved cooling techniques have enabled a rating of 350 MW to be adopted for a single-line machine. Turbine last-stage wheels provide an output of 115 MW per exhaust flow to be obtained economically. Boiler design considerations have not, so far, limited unit rating but further research into the methods of achieving effective mixing of large quantities of pulverized coal and combustion air is necessary.

621.311.153 : 681.142

7101 THE "SIELOMAT" ANALOGUE COMPUTER AND ITS APPLICATION TO AUTOMATIC OPTIMUM LOAD DISTRIBUTION AND FREQUENCY AND POWER REGULATION.
H.Bauer.
Bull. Sci. Assoc. Ingen. Montefiore (A.I.M.), Vol. 73, No. 4, 191-213 (April, 1960). In French.

When a number of power stations is interconnected, the optimum solution of load dispatching problems cannot be achieved instinctively even by the most experienced load dispatcher. The Sielomat is an electro-mechanical analogue computer which supplies data for optimum load distribution amongst a number of interconnected power stations continuously. Although the Sielomat is designed in the first instance as an aid to the load dispatcher, it can be adapted without difficulty for automatic regulation of the power stations and for frequency regulation.

A.S.Hay

621.311.16

7102 SPECIAL TURBINE CHARTS AND CHARACTERISTICS FOR CALCULATING THE OPTIMUM ACTIVE LOAD DISTRIBUTION ON A GRID SYSTEM. A.N.Zlatopol'skii.
Elekt. Stantsii, 1959, No. 12, 36-40 (Dec.). In Russian.

Maximum economy demands judicious organization of generating units on the basis of balanced incremental costs. Turbine characteristics, presented analytically, show the no-load heat rate and the incremental heat rate per MW. Charts have been employed successfully for this purpose, affording the turbine heat-rate equation with practically no calculation work, for any steam pass-out rate and any cooling-water temperature, together with an analysis of the effect of varying these quantities. Charts constructed for controlled steam pass-out, supplemented by charts for condensing turbines, provide ready analysis of operating conditions as affecting optimum load distribution.

R.Matthews

621.311.2

7103 M.H.D. GENERATION. JOINT STEAM–ELECTRIC CYCLE EFFICIENCY 60%. R.Hawley.
Elect. Times, Vol. 138, 301-5 (Sept. 1, 1960).

The classes of m.h.d. generators that have been suggested are enumerated and several different types are described. These include transverse radial field and electrodynamic machines and the plasma reactor. Problems involving thermodynamic cycles and conductivity of gases are discussed and the need for more intensive research into the possibilities of this type of generator is stressed.

G.V.Hargreaves

621.311.21

7104 A NEW SPANISH POWER STATION.
D.J.Westcott.
A.E.I. Engng Rev., Vol. 1, No. 2, 68-74 (July, 1960).

The Eume Station near La Coruna has a concrete arch dam 338 ft high set in a gorge. The two sets consist of 600 rev/min Francis turbines driving 11 kV 32 MVA alternators; special features are hydraulic pre-tensioning of rotor bolts and the use of cold-rolled plate in the rotor to give improved space factor. 3 ph. transformers connect to the 132 kV bulk-oil circuit-breakers.

P.Linton

621.311.21

7105 THE LOSTALLO GENERATING STATION OF THE INDUSTRIESTROM AG, LOSTALLO.
Lombardi, Calzolari and Garzetti.
Bull. Oerlikon, No. 338, 2-20 (Feb., 1960).

This hydro-electric station utilizes part of the waters of the catchment area of the Mosea river in the Val Mesocco, Switzerland. The station contains two turbine groups, each of 13.75 MVA, and has been in service since 1958. It is designed for fully automatic operation but will be remotely controlled at a later date. Full details are given of the civil engineering works, turbine–generator sets, transformers, and switching plant.

621.311.21

7106 HYDRO-ELECTRIC POWER IN BURMA.
C.H.Mellor.
Elect. Rev., Vol. 167, No. 3, 102-4 (July 15, 1960).

The present installed capacity of the Lawpita Falls hydro-electric station is 84 MW; this will be raised to 168 MW. The three water turbines are 428.5 rev/min 40 000 h.p. horizontal shaft, double runner, four-jet Pelton-wheel machines. The complete Balu Chaung project will consist of three stations with a total capacity of 240 MW. A brief history is given of the Rangoon electricity supply system and the transmission system is mentioned.

Central Electricity Generating Board Digest

621.311.21

7107 PLANT AND EQUIPMENT FOR PUMPED STORAGE SCHEMES. B.K.R.Prasad.
Elect. J., Vol. 165, No. 4, 212-14 (July 22, 1960).

A summary of the principles of pumped storage, with descriptions of the Schluchsee, River Awe and Blaenau Ffestiniog schemes.

P.Linton

621.311.21

7108 VIANDEN PUMPED STORAGE SCHEME.
Engineer, Vol. 210, 326-7 (Aug. 19, 1960).

A major hydro-electric pumped storage plant has been under

construction since July, 1959, near Vianden in Luxembourg. The station will supply peak energy by means of a daily cycle of eight hours' pumping and four-and-a-quarter hours' generation, making use of the water of the river Our of which about 10 hm^3 (1 hm = 1 cubic hectometre = 10^6 m^3) are to be impounded in a reservoir extending for about 8 km along the valley. A volume of nominally 4.84 hm^3 will circulate between this and the 6 hm^3 upper reservoir sited on a nearby hilltop which rises nearly 300 m above the valley. Of the total installed generating capacity of 800 MW, and the 552 MW pumping capacity, one half will be in commission by the autumn of 1962. Annual generation will then amount to 600 GWh and this can subsequently be doubled. Overall cycle efficiency is expected to exceed 70%.

621.311.21

7109 ASPECTS OF THE PLANNING OF PURE PUMPED-STORAGE STATIONS.

K.Haager, F.Hartmann and O.Uitting.
Elektrizitätswirtschaft, Vol. 59, No. 10, 307-15 (May 20, 1960). In German.

There are relatively few situations where pumped storage in conjuction with hydro-electric generation is clearly justifiable. The large size of modern steam-generating units however, renders them unsuitable for dealing with even daily variations of load and a pumped-storage scheme may be an economic adjunct. Such schemes call for close collaboration between civil, hydraulic, mechanical and electrical engineers and the advice of geologists. The article is a useful review of matters for consideration. Forms of civil works and types of plant are discussed. Actual and projected schemes are compared as regards total costs and their allocation between sections of the works. A.P.Wilmshurst

621.311.21

7110 THE DESIGN OF HYDROELECTRIC POWER STATIONS ON LOWLAND RIVERS. G.K.Bartl.

Elektrizitätswirtschaft, Vol. 59, No. 11, 360-5 (June 5, 1960). In German.

The hydroelectric potentialities of the Weser river between Minden and Bremen have been developed extensively since 1952. This stretch of water is 162 km long, the difference in head being 37m. Power stations and weirs have been erected at Schlüsselberg, Drakenberg and Langwedel. All the plants have been designed as multi-purpose installations for economic reasons. The power station at Landesbergen has been under construction since 1958 and will be completed at the end of 1960. This station contains three turbines driving generators each rated at 3000 kVA and 500 rev/min. A step-up gear is installed between each turbine and generator. The turbines are started by evacuating the portion of the runner chamber above water level. They can be shut down quickly by draining the runner chamber and high speed closure of the inlet sluices can be dispensed with. Considerable saving in both civil and electromechanical engineering costs can be achieved by this design. A.S.Hay

621.311.21

7111 PROSPECTS OF HYDRAULIC POWER DEVELOPMENT. H.Christaller.

Elektrizitätswirtschaft., Vol. 59, No. 13, 410-18 (July 5, 1960). In German.

Long-term cost trends are estimated for different types of generating plant. There are excellent prospects for pumped storage schemes. P.Linton

621.311.21

7112 EXPERIENCE WITH COORDINATED DAY PEAK LOAD OPERATION OF WATER POWER STATIONS.

R.Clausnizer.
Elektrizitätswirtschaft, Vol. 59, No. 13, 429-35 (July 5, 1960). In German.

Details are given for 2 groups of 4 power stations on the Iller and a group of 7 on the Lech, Bavaria. The effect of pondage and river flow on the peak load output are discussed theoretically; a conversion efficiency of 70% from base to peak power can be achieved with a much lower capital cost than using pumped storage. P.Linton

621.311.21

7113 EXPERIENCE IN THE AUTOMATIC OPERATION AND REMOTE CONTROL OF HYDROELECTRIC STATIONS.

H.Henninger.
Elektrizitätswirtschaft, Vol. 59, No. 13, 436-40 (July 5, 1960). In German.

The Schluchsee pumped storage scheme, South Germany, incorporates automatic starting, stopping and load changing under the control of the central controller, with provision for adjusting the load sharing between the stations. More than 3000 load changes are made in 6 hours; the 110 V d.c. relays are comp.etely overhauled every 2 years and have proved reliable in service. P.Linton

621.311.21

7114 PIRTTIKOSKI POWER STATION. H.Sistonen.

Kraft o. Ljus, Vol. 33, No. 7-8, 135-42 (July-Aug., 1960). In Swedish.

Describes the civil engineering work on this station on the Kemi river in N.Finland. The catchment area above the dam is 28 000 km^2 The rated intake of the station will be 500 m^3/s, divided between two turbo-generator sets. The head is 25.5 m. After regulation the generated energy should be 530 GWh/yr. The penstock is a tunnel beginning just above the regulation dam; the tunnel and discharge channel are 3 km long. Special attention is given to the floatway construction. The turbines are vertical-axis Kaplan types and the generators are designed for 70 MVA output at 13.8 kV. G.N.J.Beck

621.311.21

7115 ZAMBEZI HYDRO-ELECTRIC DEVELOPMENT AT KARIBA, FIRST STAGE.

D.Anderson, T.A.L.Paton and C.L.Blackburn.
Proc. Instn Civil Engrs, Vol. 17, 39-60 (Sept., 1960).

Deals with the initiation and construction of the first stage of power development (600 MW) on the River Zambezi at Kariba Gorge in the Federation of Rhodesia and Nyasaland. The scheme comprises a double-curvature concrete arch dam, 420 ft high, and an underground power house to accommodate six turbo-generators, each of 100 MW capacity. The design and construction was completed in 4½ years at an estimated cost of £75 million. The lake formed by the dam with an area of 2000 sq. miles will be one of the largest natural reservoirs in the world. The paper covers the broader aspects of the technical design and the planning and organization of the construction work. It includes, as appendices, references to earlier studies of the scheme and to the organizations responsible for its construction.

621.311.21

7116 THE ASWAN HYDRO-ELECTRIC SCHEME. V.Furuskog and G.F.Kennedy.

Proc. Instn Civil Engrs, Vol. 17, 201-18 (Oct., 1960).

Describes the main features of the civil engineering works associated with the design and construction of the 350 MW hydro-electric scheme on the River Nile at Aswan in Egypt. It also outlines the principal mechanical and electrical characteristics of the generating plant comprising seven 47 MW and two 11.5 MW vertical Kaplan turbines and alternators operating over a range of 10-33 m to meet prevailing hydraulic conditions which are largely determined by reservoir operation and irrigation requirements. In addition, the associated auxiliary equipment essential for station control and operation is briefly detailed.

621.311.21

7117 SLAPY POWER STATION. M.Nechleba.

Water Pwr, Vol. 12, No. 10, 390-5 (Oct.); No. 11, 417-20 (Nov., 1960).

An account is given of the civil, mechanical and electrical design features of this 50 MW plant on the Vltava in Czechoslovakia. The second part describes mechanical equipment, with special reference to the turbines.

621.311.21/22

7118 THE CHOICE BETWEEN WATER AND THERMAL POWER DEVELOPMENT. T.Hedin.

Svenska Vattenkr Fören. Publ. No. 481 (1960 : No. 9) 155-70. In Swedish.

An economic comparison is made of the two types of power station, based on existing and planned stations in Sweden. The calculation is based on the cheapest total power costs per kWh primary load, and an "exploitation coefficient" is introduced, this being the ratio of the possible mean annual generation to the primary load. Because of the trend towards larger thermal stations working at higher temperatures and pressures — for S.Sweden in particular — and the increased availability of oil fuel, and owing to the higher

capital costs of exploiting the more remote hydro-electric resources and the long transmission lines entailed, it is concluded that thermal stations will be more economic in 1965-70. G.N.J.Beck

621.311.21/.22

7119 THERMAL–HYDRAULIC GENERATION INTEGRATION IN SOUTHERN MANITOBA AND NORTHWESTERN ONTARIO. C.G.Mills and H.Teekman.
World Power Conf., Canadian Sectional Meeting (Montreal, 1958), Section A3, Paper 93 A3/4, 16 pp.

These two systems were electrically interconnected in 1956. In both areas, when the economic hydraulic sites have been developed, new generation will be mainly thermal. In North-Western Ontario, the ultimate capacity to be developed at any hydraulic site is evaluated by using as a criterion the cost of delivering the equivalent power and energy to an assumed load centre from a thermo-electric plant. If thermal generation is introduced in combination with hydraulic, higher installed capacities can be justified and the demand for water storage will be less, although storage will still be used and estimates of its value will have to be made annually as the system changes. The use of conventionally fired or nuclear plants will not affect the general situation. Coal is not found in abundance in either area. In Manitoba, it will be obtained from Saskatchewan and in Ontario from the United States. There is natural gas in Western Canada, but it is not likely to be competitive with coal. E.W.Golding

621.311.22

7120 SUPER-CRITICAL PLANT AT DRAKELOW "C".
Elect. Rev., Vol. 167, No. 8, 296-8 (Aug. 19, 1960).

Two 375 MW supercritical turbo-generator/boiler units are to be installed at Drakelow "C" power station. Steam conditions at the t.s.v. will be 3500 lb/in² and 1100°F/1050°F reheat. The principles and application of supercritical plant are discussed and the development of power station heat cycles which have led to supercritical conditions are considered. Brief details are given of the plant which is due for commissioning in 1965.
Central Electricity Generating Board Digest

621.311.22

7121 NORTHFLEET POWER STATION.
Elect. Rev., Vol. 167, No. 9, 329-36 (Aug. 16, 1960).

The Northfleet power station will contain six 120 MW turbo-generator-boiler units, the first of which has already been commissioned. Steam conditions at the t.s.v. are 1500 lb/in² and 1000°/1000°F reheat. Each of the six single-drum natural circulation water-tube boilers has a maximum continuous evaporative capacity of 860 klb/hr. The coal, ash and dust handling systems, turbines, generators, and electrical connections are described. Interesting features of the station, which is due for completion in 1962, include an automatic data logging system, the use of a fabricated l.p. turbine outer casing with an integral foundation beam, a sectional condenser welded on site, an unusually comprehensive turbine governing system and basalt-lined ash pipes.
Central Electricity Generating Board Digest

621.311.22

7122 FERRYBRIDGE B POWER STATION.
Elect. J., Vol. 164, No. 19, 1286-9 (May 6, 1960).

The new station in Yorkshire operates on coal of low calorific value and has rail and river access. 3 boilers each deliver 760 000 lb/h steam at 1500 lb/in²/975°F/955°F to a 3-cylinder turbine driving a 100 MW 0.8 p.f. 13.8 kV hydrogen-cooled alternator. 120 MVA transformers connect 2 sets to the local 132 kV grid and the third to the 275 kV national grid through 3500 MVA oil circuit breakers. P.Linton

621.311.22

7123 COMBINED STEAM TURBINE–GAS TURBINE GENERATING PLANT.
Elect. J., Vol. 165, No. 5, 265-7 (July 29, 1960).

A steam turbine–gas turbine generating plant to supplement existing hydro-electric facilities has been constructed at Plant Crisp, Georgia. The simple-cycle, single-shaft gas turbine is rated at 5 MW and the steam turbo-generator is rated at 12.5 MW. On full load, the gas turbine has an output of 99×10^6 B.t.u./hr with an air exhaust volume of 35 klb/hr at 840°F. The boiler is a two-drum, Stirling, 130 klb/hr, 625 lb/in² at 850°F, pressurized type. Production costs based on the first six months of operation are tabulated. Central Electricity Generating Board Digest

621.311.22

7124 A RAPID METHOD FOR DETERMINING THE MOST ECONOMIC REGENERATIVE CYCLE OF A THERMO-ELECTRIC PLANT. G.Chiantore, D.Borgese and F.Baldo.
Energia elett., Vol. 37, No. 4, 322-41 (April, 1960). In Italian.

The procedure consists of first calculating an accurate heat balance for some condition close to the optimum, and then altering one primary variable at a time and calculating the cost variation to determine the optimum value. The optimum design incorporates all the individual optimum values. P.Linton

621.311.22

7125 MARGAM "B" POWER STATION.
Engineer, Vol. 210, 101-3 (July 15, 1960).

To meet the requirements of an additional 200 000 lb/hr of steam the Steel Company of Wales has installed a Benson boiler operating at 3300 lb/in² and 1060°F, arranged to burn blast-furnace gas, fuel oil, or a combination of the two. The unit feeds a high-pressure back pressure turbo-alternator of 9.5 MW rating arranged for inlet pressure governing; the boiler output can be varied by an adjustable load setter which controls the fuel, the feed water, and the steam temperature. A description of the boilder construction is included together with brief details of the turbine casing.
M.Rathbone

621.311.22

7126 THE HÄSSELBY STATION (SWEDEN).
G.Brismar and I.Wernius.
E.R.A. (Stockholm), Vol. 33, No. 8, 91-5 (1960). In Swedish.

Hässelby is a new power and district heating station in Stockholm. It has a present electrical output of 80 MW and a thermal output of about 150 G cal/h. Heat is supplied in the form of circulated hot water to some 60 000 consumers. Three high-pressure boilers feed steam to two double-rotation (28 and 26 MW) back-pressure turbo-generator sets and to a third (32.6 MW) set which can be used either for back-pressure or condensing operation. Electrode boilers and low-load steam boilers are provided for summer operation when heat is needed only for hot-water production. Each turbo-set has its own 6 kW busbars which feed the public supply via local transformers. The station began operation in September 1959 and ran continuously until the end of April 1960. The energy produced in that period was 180×10^6 kWh.
G.N.J.Beck

621.311.22 : 621.311.18

7127 LARGE THERMAL POWER STATIONS AND THEIR ELECTRICAL AUXILIARY SERVICES. I. J.Riviere.
Rev. Electrotec., Vol. 46, No. 6, 199-208 (June, 1960). In Spanish.

A general account of recent trends in size, steam cycles and other characteristics of large thermal power stations and their influence on the selection of the electrical auxiliary services, with particular reference to boiler feed pumps. H.Norel

621.311.22

7128 THE 125 MW MONOBLOC UNIT OF THE LANGERBRUGGE POWER STATION. J.Ryffranck.
Votre Electricite, Vol. 31, 10-40 (Feb., 1960). In French.

The new unit of this Belgian station supplements 5 sets totalling 150 MW and has involved a considerable extension of the services. The critical-pressure Benson boiler of 100 ton/h can be fed with either pulverised coal or fuel oil. The 127 kg/cm² 540°C/535°C turbine has 3 cylinders and drives the 15 kV 154 MWA hydrogen-cooled alternator. The 150 kV switchyard has two step-up transformers and is linked with Schelle station by a single-circuit line. P.Linton

621.311.22

7129 THE PONT-BRÛLÉ POWER STATION OF THE "INTERBRABANT". W.Dufour.
Votre Electricite, Vol. 31, 15-32 (April, 1960). In French.

This is the third power station of this system, the output of this thermal station will be 750 MW. The first stage comprises 120 MW and was taken into service in January 1960. The steam conditions are 1830 lb/in², 1004°–977°F at the turbine inlets. The guaranteed fuel consumption is 1913 kcal/kWh at an economic load of 110 MW per set. A very detailed description of the fuel supply (coal, heavy oil), ash removal gear, boiler plant (with air pre-heaters, reheaters, economizers), steam control, of the turbo-alternator transformer sets (3000 rev/min, 7 bleed points) is given with detailed diagrams of the entire installation. J.Smuts

621.311.22

7130 UPGRADING MINING PRODUCTS AND OTHER INFERIOR FUELS IN HIGH-PRESSURE HIGH-TEMPERATURE STATIONS. C.Wilwertz.
World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper IIA$_1$/4, 21 pp. In French.

Gives the main characteristics of the 100 to 125 MW sets presently under erection or in operation in Belgium and makes a summary of the world situation concerning installations designed for 1100° F and more. Some particularities of these installations are analysed, and a calculation of their economics is made, with application to a definite case, taking into account the trends of the essential parameters. A second part of the paper is devoted to the use, in Belgian power plants, of slurry, high ash content fines and shales of coal mine reject dumps, as well as liquid and gaseous low-grade by-products of the oil industry, and also of blast furnace gases, burned simultaneously with other fuels.

621.311.22

7131 ECONOMIC CONTROL OF COOLING WATER FLOW IN STEAM POWER STATIONS. F.S.Aschneer and A.Kikinis.
World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper IIA$_1$5, 16 pp.

A method for determining the economic cooling water flow in existing condensing steam power stations is developed. If additional investment and technical complications for variation of the pump speed or adjustment of the pump vanes are to be avoided, shutting-off of cooling water pumps is the most economic solution. The shut-off points recommended at varying loads and cooling water temperatures can be shown in diagrams which are suitable as operating instructions. Examples of such diagrams are given for different types of power stations. Measurements have confirmed the method developed.

621.311.22

7132 THE COMBUSTION OF LOW-GRADE FUELS IN CZECHOSLOVAK POWER INSTALLATIONS.
V.Zeman and L.Tintner.
World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper IIA$_1$/13, 24 pp.

After referring to the fuel situation in Czechoslovakia and to its prospective development, the report indicates its influence on the design of steam boilers and furnaces for the combustion of low-grade fuels. Some characteristic types of boilers and combustion devices for this purpose are described and the measures indicated which will be taken in the development of new furnace designs for use in Czechoslovak public power plants and industry.

621.311.22

7133 INFLUENCE OF GEOMETRIC CHARACTERISTIC [PROPERTIES] OF [HEAT EXCHANGERS MADE OF] BUNDLES OF TUBES ON THE CONDENSATION OF STEAM FROM STEAM-AIR MIXTURES IN VACUO. V.A.Rachko.
Zh. tekh. Fiz., Vol. 30, No. 7, 868-80 (July, 1960). In Russian.

The rate of heat- and of mass-transfer in different heat exchangers and parts of heat exchangers is derived by evaluating results of numerous measurements. The difference in performance of outer and inner tubes in a bundle is investigated and the effect of the spacing of the tubes is studied. R.Eisenschitz

621.311.23

7134 POWER GENERATION BY LARGE GAS TURBINE UNITS. L.E.Lingstrand and J.R.Schnittger.
World Power Conf., Canadian Sectional Meeting (Montreal, 1958) Section B4, Paper 22 B4/8, 14 pp.

In Sweden, thermal power supplements the prevailing water power and, for this purpose, gas turbines could be particularly favourable if their capital cost were sufficiently low in relation to that of condensing steam power plant to offset their relatively high running cost. The best economy results if about 20 or 25% of the power projects are developed as thermal power plants with an average load factor of about 0.1 or 0.2. The 40 MW gas turbine plant in Vastervik, on the Swedish east coast, is an end-of-line generating plant, constructed on the principle of low fixed charges and convenience for peak load and power-factor-correction service. The average load factor will not exceed 0.1. The total cost is estimated to be 17.5×10^6 kronor, exclusive of the harbour and oil storing arrangements, and the specific cost 440 kronor per kW. A graph shows how the specific construction cost would vary with the number of units. Diagrams are also given of the lay-out of the plant and of the power station, of the operation schedule, of the variation of the rate of efficiency with the load and of the possible power capacity with varying air and cooling water temperatures. E.W.Golding

621.311.25

7135 PRESENT PROGRESS AND TECHNICAL AND ECONOMIC ASPECTS OF NUCLEAR POWER STATIONS. J.M.O.Navascués.
Dyna, Vol. 35, No. 5, 346-59 (May, 1960).

621.311.25

7136 ADVANCED GAS-COOLED REACTOR.
Elect. Rev., Vol. 166, No. 24, 1105-12 (June 10, 1960), Also in Engineer, Vol. 209, 966-70 (June 10), 1002-7 (June 17, 1960).

The prototype for the next "generation" of civil nuclear power stations to be built in the late 1960's is under construction at Windscale, Cumberland. The project, costing £9 million, will produce 100 MW of heat with a net electrical output of 28 MW. The fuel consists of ceramic uranium dioxide in beryllium or stainless steel cans. It is expected that the project will be commissioned in April 1961 and will be operating at full power by the following October.

621.311.25 : 621.316.728

7137 THE CONTROL OF NUCLEAR REACTORS. A.Di Loreto.
Ingegnere, Vol. 34, No. 3, 224-7 (March, 1960). In Italian.

Nuclear reactors are usually controlled by using absorbing rods. The insertion of these rods perturbes the flux distribution. A simple model of a bare homogeneous cylindrical reactor with a single cylindrical "black" control rod inserted along the axis is treated using one and two group theory. Analytical expressions are obtained for the flux distribution. R.D.Smith

621.311.25

7138 SOME CONTRIBUTIONS FROM NUCLEAR POWER TO ENGINEERING PRACTICE. I.Davidson.
Proc. Instn Civil Engrs, Vol. 17, 121-36 (Oct., 1960).

Illustrates some facets of recent progress in engineering practice which have been associated with the nuclear power programme. Problems with large steel pressure vessels are briefly described and the means adopted to overcome them are discussed; the possible consequences on general engineering practice are mentioned. A similar treatment of the design and construction of concrete biological shielding indicates that in this case useful progress has been made in meeting nuclear requirements in such a way that largely conventional practice may be successfully applied. These two subjects lead to a proposal for large prestressed concrete pressure vessels, of which some basic design parameters are outlined.

621.311.25

7139 A DESIGN STUDY OF HEAVY-WATER-MODERATED POWER REACTORS.
F.W.McCloskа and C.A.Hatstat.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1698-705 (1960) = Pwr Apparatus Syst., No. 46 (Feb., 1960).

The objectives of the study were a conceptual design offering the greatest promise of economic nuclear power and a preliminary design, plus cost estimate, of a prototype plant of the minimum size necessary to demonstrate the recommended concept. The prototype plant should be capable of operation by mid-1963. The conceptual design was based on a 200 MWe turbogenerator ouput. A boiling heavy-water, pressure-tube, direct-cycle system using natural uranium was chosen. This had both the lowest capital costs and operating costs. The various types considered are discussed and details are given of the plant characteristics and costs of six types. The power costs of the chosen type were about 11 mills/kWh. The prototype is discussed in some detail, it could produce 69 MWe at a net plant efficiency of 27 . The power cost is estimated to be about 19 mills/kWh, potential improvements leading to a reduction in this cost of 2 mills/kWh are noted. A.J.Salmon

o21.311.25

7140 FRENCH NUCLEAR POWER STATIONS PROGRAMME. C.Leduc and J.P.Roux.
World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper IVA/8, 23 pp. In French.

The evolution of techniques applied in the designing of French nuclear power plants and the means employed for reducing costs

per kWh of E.D.F.$_1$ and E.D.F.$_2$ compared with E.D.F.$_3$ are described. Electric power per ton of uranium varies from 493 kW/t for E.D.F.$_1$ to 970 kW/t for E D.F.$_3$. The thermal power and electric power of units have been changed from 290 MWt for E.D.F.$_1$ to 1200 or 1600 MWt for E.D.F.$_3$ and from 28 MW to 250 MW, respectively. The results were obtained by an improvement in neutron characteristics, developments in nuclear fuel technology, and simplification of the system of charging the reactor, the ease of maintenance of which has been improved. The E.D.F.$_3$ heat-exchangers have been so designed as to increase the unit power of the elements, which will attain 9 MWt, as against 3 for E.D.F$_1$. For E.D.F.$_3$ an advance project forecasts a thermodynamic layout with only one pressure stage. A description of the burst-slug detection systems is given, and an appendix gives a detailed comparative table of E.D.F.$_1$, E.D.F.$_2$ and E.D.F.$_3$ plant characteristics.

621.311.25

7141 NUCLEAR HEAT AND POWER FOR THE CITY OF STOCKHOLM. THE JOINT SWEDISH PROJECT.

E.G.Malmlöw, C.Mileikowsky, S.Ryman and I.Wivstad.
World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper IVA/1, 24 pp.

The rising electricity demand and gradual exhaustion of economic hydropower sites points to the need to bring into operation a large amount of thermal generating plant on the Swedish system in the 1970s, and trade balance considerations favour the selection of nuclear stations, with natural uranium in particular. Further improvements in the trade balance could be achieved if currently oil-burning district heating schemes in Sweden went over gradually to the use of heat from nuclear stations. This general background has led to work on a heavy-water moderated natural-uranium reactor with an initial thermal rating of 65 MW, which should give experience for the subsequent programme on larger generating stations and for application to district heating. The Atomic Energy Company, state and privately owned electricity undertakings and private industry are all engaged on this project, which will initially supply 10 MW of electricity from a back-pressure turbine, and 55 MW of heat in the form of hot water from the turbine condenser for the purpose of space heating in Stockholm. It is envisaged that these figures will be considerably increased later by installing additional heat exchangers. The nuclear part of this project is located underground in a steel-lined rock excavation, about 3 km south of the city borders, whilst the turbine is located above ground. As distinct from the Canadian heavy-water-moderated reactors, where it is proposed to use pressure tubes to contain the coolant, the Swedish unit uses a "pressure vessel design" with a common moderator and coolant circuit, with coolant inlet and outlet temperatures of 205 and 220° C, respectively. This design gives good self-regulating properties. A description of the building and mechanical design is given and the basis of the thermal design is described in some detail.

621.311.25 : 621.315.687

GASTIGHT CABLE BUSHINGS IN THE KARLSRUHE REACTOR FR 2. See Abstr. 5408

621.311.4

7142 SOME ASPECTS OF THE SUBSTATIONS OF THE AMSTERDAM MUNICIPAL SUPPLY AUTHORITY.

N.J.Blokker.
Electrotechniek, Vol. 38, No. 19, 486–90 (Sept. 15, 1960). In Dutch.

Sixteen substations are now in use, ten for 10 kV and six for 50 kV. Transformer units installed vary between 2 and 20 MVA, the average power in 1958 being 7.9 MVA. In the new 50 kV switching substations, wall isolators are used in which straight-through insulators through walls serve as isolating knives for the isolators. The substations are designed for a symmetrical s.c. power of 2000 MVA at 50 kV. Automatic voltage regulation and protection are briefly described. G.N.J.Beck

621.311.4 : 628.972

LIGHTING OF INDOOR SUB-STATIONS FOR VOLTAGES OVER 60 kV. See Abstr. 6689

621.311.42

7143 THE SVERDLOVSK SUBSTATION FOR 500 kV.

L.D.Gustov, M.I.Levin, A.M.Marinov, L.M.Mizin and A.P.Petrokov.
Elektrichestvo, 1960, No. 7, 61-5 (July). In Russian.

The Sverdlovsk substation now under construction will receive energy from the Volga and Votkinsk hydroelectric stations and from large thermal generating stations in the Urals. The overall project is based on the reconstruction of an existing 220/121/11 kV substation, by the erection of 500 kV and 35 kV oil circuit-breakers (more suitable than air-blast breakers for the climatic conditions of the Urals), autotransformers and auxiliaries. For reasons of economy, a quadrangle-type circuit was chosen.

Electrical Research Association

621.311.42

7144 THE CONSTRUCTIONAL PLANNING OF 380/220 kV TRANSFORMING STATIONS. H.Petzold.

Elektrie, Vol. 14, No. 6, 218-22 (June, 1960). In German.

The layout of large transforming stations is discussed, taking as an example a 380/220/110 kV substation. There are fifteen 380 kV switch bays, 8 feeders, 4 transformers, 1 coupler and 2 section switches. The 630 MVA transformers consist of three 1-phase units of the mobile type with tap-changers. The switchgear is of conventional double-busbar type but with rather elaborate auxiliary and transformer busbars. A.P.Wilmshurst

621.311.47

7145 RATIONALIZATION OF LAYOUTS OF OUTDOOR SWITCHGEAR. W.Schrinner and H.Pawlik.

Elektrie, Vol. 14, No. 6, 222-7 (June, 1960). In German.

The space and structural material required for outdoor switchgear depends greatly on the type and arrangement of the busbar isolators; circuit-breakers and instrument transformers require about the same space in all layouts. For the East Berlin 110 kV system 2 arrangements have been standardized; three 2-stack horizontal isolators are placed in line or three 1-stack pantograph isolators are arranged diagonally, The same considerations apply to 220 and 380 kV layouts. A.P.Wilmshurst

621.311.6 : 621.383.292

7146 BATTERY POWERED CONVERTER RUNS MULTIPLIER PHOTOTUBE. R.P.Rufer.

Electronics, Vol. 33, No. 28, 51 (July 8, 1960).

Describes, with component values, a supply for a multiplier phototube detector. A string of Cockcroft–Walton voltage-doublers avoids the quiescent current drain associated with the more normal bleeder resistance, and produces the high voltage by multiplying the output from a d.c. convertor fed by a small battery.

E.F.Hansford

ELECTRIC MACHINES

621.313.1 : 621.314.2

7147 ELECTRO-THERMAL PROBLEMS [IN MACHINES AND TRANSFORMERS]. K.L.Morphew.

Brit. Pwr Engng, Vol. 1, No. 3, 33-6 (Aug. 1960).

Discusses various methods for measuring or predicting temperature rise as in rotating electrical machines or transformers, with particular reference to Freeman's classical equations for heating and cooling of a homogeneous body. Modifications of those equations to allow for non-uniformity of temperature within the body are suggested. A rigorous test using Freeman's graphical method of calculation leads to a final experimental accuracy of ±3½% and the maximum internal temperature may be determined without performing a full-length heat run. A.P.Paton

621.313.1

7148 SYMMETRICAL COMPONENTS OF THE INSTANTANEOUS VALUES, OR VECTORS OF THE ELECTRICAL QUANTITIES? K.P.Kovács.

Arch. Elektrotech. (Berlin), Vol. 45, No. 2, 99-117 (1960). In German.

Symmetrical components of instantaneous values have been used increasingly for the study of transient phenomena in three-phase systems. It is demonstrated that the space vector, which is the vector-sum of the instantaneous phase quantities (currents, voltages, fluxes) can be used more readily and that it makes the use of symmetrical components of instantaneous values unnecessary. In the case of three-phase machines, it has also a clear physical meaning. As with symmetrical components, the zero-sequence effects must be dealt with separately. The application of the space-vector concept is illustrated by investigations into the apparent

time-constant of the stator direct-current during the three-phase short-circuit of a cylindrical-field synchronous machine, and by calculations of the induction-motor torque when direct current is applied to the three phases in rotation for inching purposes. A bibliography is included. H.Sterling

621.313.1

7149 CALCULATING AIR FLOW THROUGH ELECTRICAL MACHINES. J.L.Taylor.
Elect. Times, Vol. 138, 82-4 (July 21, 1960).

The essential background for the analysis and predetermination of the loss characteristics of a ventilation system with sufficient accuracy to give confidence in applying the calculated results to determine the most suitable fan for the purpose required is described. G.V.Hargreaves

621.313.1

7150 BRUSH WEAR IN SMALL MACHINES. F.Schröter.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 16, 381-7 (Aug. 8, 1960). In German.

The statistical evaluation of numerous measurements on small machines, mainly universal motors, is used to derive criteria on which the wear of brushes depends, and from which it may be predicted with a tolerance of ±50%. The results of many tests are given in the form of tables and graphs. J.T.Hayden

621.313.1 : 621.34

7151 TEMPERATURE RISES IN ELECTRICAL MACHINES WITH SUSTAINED VARIATIONS IN LOAD AND SPEED. B.J.Prigmore.
Proc. Instn Elect. Engrs, Monogr. 416 U, publ. Nov., 1960, 7 pp. To be republished in Part C.

A method is presented for obtaining the temperature-rise/time curve for a given machine for an arbitrary sequence of operating currents and speeds; the method is demonstrated to give results for such a run correct to about ±2°C in 60-70°C. The method is to suppose that the equivalent thermal network of the machine is linear, its temperature/time curve thus being the sum of the temperature/time transient responses for a series of short times, δt, successive transients corresponding to the average operating conditions during successive intervals; and then to modify this curve to that for the actual nonlinear machine by adding a correction curve which is itself composed of two series of transient responses: one of these allows for the effects of nonlinearity due to temperature rise, and is based upon the succession of average temperature, given from the first curve, during the intervals δt; the other allows for the effects of changes in dissipation coefficients due to changes in speed. The test-bed procedure for obtaining the temperature/time transients for the linear machine, and the corrections for nonlinearity, is specified. It is recommended that this procedure, lasting about 36 hours, should be applied to samples of appropriate types of machine.

621.313.1 : 681.142

7152 NUMERICAL EVALUATION OF INDUCTANCE AND A.C. RESISTANCE. R.S.Mamak and E.R.Laithwaite.
Proc. Instn Elect. Engrs, Monogr. 418 U, publ. Nov., 1960. 7 pp. To be republished in Part C.

The electric and magnetic circuits of electrical machines are generally so complex that the exact evaluation of such quantities as leakage reactance and a.c. resistance is virtually impossible. With the advent of digital computers it has become feasible to develop numerical methods of predetermining the flux pattern in such cases. In the paper the finite-difference equations for electromagnetic systems are obtained, and the inductance is calculated by intergrating the magnetic vector potential over conducting surfaces. The same finite-difference equations are applied to the calculation of a.c. resistance of conductors in slots. The use of the method is illustrated by examples of standard transformers, a tap-changing transformer, calculation of the leakage reactance of the field winding of a salient-pole-alternator and the screening of d.c. poles in a new type of oscillating synchronous linear machine.

621.313.1

7153 DYNAMIC CIRCUIT THEORY. H.K.Messrle.
Trans Amer. Inst. Elect. Engrs III, Vol. 79, 1-12 (1960) = Pwr. Apparatus Syst., No. 47 (April, 1960).

Covers the theory of electromechanical transducers and systems of such transducers. The general principles and techniques are surveyed and examples are given of this method of approach to the problem of electrical machine design. V.G.Welsby

621.313.1-9

7154 MOTORS FOR THE CHEMICAL INDUSTRY. F.H.Merrill.
Elect. Rev., Vol. 167, No. 6, 216-19 (Aug. 19, 1960).

The chemical industry raises special problems due to chemical corrosion and possible flooding by corrosive liquors, while some chemical plants handle materials which create an explosion hazard. Some of the methods used to overcome these problems are described, and details are given of the characteristics of the various motors and control systems employed.

621.313.1-9 : 621.34

7155 CHARACTERISTICS OF CENTRIFUGAL PUMPS AND COMPRESSORS WHICH AFFECT THE MOTOR DRIVER UNDER TRANSIENT CONDITIONS. H.A.Wiegand and L.B.Eddy.
Trans Amer. Inst. Elect. Engrs II, Vol. 150-6 (1960) = Applic. and Industr., No. 49 (July, 1960).

Centrifugal-pump and compre sor characteristics at varying speed and operating conditions are discussed with the help of curves. These are used to estimate the load speed—torque characteristics during starting and immediately following supply failure on the driving motor. A short discussion is included. H.Sterling

621.313.12 : 621.316.722

7156 VOLTAGE AND CURRENT REGULATION OF GENERATORS WITH PERMANENT MAGNETS. J.Matějka.
Elektrotech. Obzor, Vol. 49, No. 7, 356-9 (1960). In Czech.

Describes a design for a small-car generator with contact rectifier and magnetic amplifier as voltage regulator. Permanent magnets are used. Discusses voltage- and current-regulation in the case of a.c. generators, and rectifying bridge arrangements. A calculated example is given. N.Klein

621.313.126 : 621.311.1

7157 AN ELECTRIC UTILITY BRUSHLESS EXCITATION SYSTEM. E.C.Whitney, D.B.Hoover and P.O.Bobo.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1821-8 (1960) = Pwr Apparatus Syst., No. 46 (Feb., 1960).

Excitation current is furnished to the field of a synchronous generator through a rotating rectifier from an a.c. exciter, all the components of which are coupled to the generator shaft. Excitation energy controlled by a magnetic amplifier regulating system is fed into the stationary field of the a.c. exciter. The use of silicon diodes ensures reliability at 3600 rev/min. A 180 kW brushless excitation system is being tested and will be applied to a generator rated at 50 000 kVA. Performance requirements have been determined from computational studies, which is covered in following abstract. A.J.Ingels

621.313.126 : 621.311.1

7158 ANALYTICAL STUDIES OF THE BRUSHLESS EXCITATION SYSTEM. R.W.Ferguson, R.Herbst and R.W.Miller.
Trans Amer. Inst. Elect, Engrs III, Vol. 78, 1815-21 1865-21 (1960) = Pwr Apparatus Syst., No. 46, (Feb., 1960).

A computer study indicated and substantiated several performance advantages of the system, compared to a system using a conventional d.c. exciter. There is an improved overall time constant, and since the generator time delay is quite large compared to the delays of the magnetic amplifiers and the exciter, the system could be stabilized for all types of transient disturbances and under all operating conditions. It is not practical by actual field test procedures to subject the system to some of the possible types of disturbances that may occur, but a detailed computer representation permits the acquisition of this important information. Reliability, care of maintenance and design considerations are discussed in the preceding abstract. A.J.Ingels

621.313.2

7159 MAGNETOHYDRODYNAMIC GENERATION OF D.C. ELECTRICAL POWER. G.W.Sutton.
Direct Curr., Vol. 5, No. 1, 25-8 (June, 1960).

A simple introductory review of the principles and difficulties associated with the idea of magnetohydrodynamic generation. G.D.Sims

621.313.2

7160 COMPENSATING WINDINGS FOR D.C.MACHINES. J.E.MacFarlane.
Elect. J., Vol. 165, No. 2, 92-3 (July 8, 1960).

Armature reaction and compensating windings are discussed in general terms. A graphical method is described which shows the requisite arrangement of the conventional type of compensating winding to give almost 100% compensation. G.V.Hargreaves

621.313.2-9

7161 THE EFFECT OF RECTIFIER POWER SUPPLY ON LARGE D.C. MOTORS. R.M.Dunaiski.
Trans Amer. Inst. Elect. Engrs III, Vol. 79, 253-9 (1960) = Pwr Apparatus Syst., No. 48 (June, 1960).

When a d.c. machine is fed through a power rectifier the presence of ripple in the voltage affects commutation, heating of the armature, vibration of the machine and the magnitude of voltages appearing axially down the motor shaft. Results of tests made on a machine originally designed as a 750 V 1 250 kW generator are described. It is concluded that commutation is significantly affected by the presence of ripple currents and that higher shaft voltages generated require more attention to pedestal bearing and insulation; the effects on armature heating and vibration are of less importance. M.Rathbone

621.313.222-9

7162 THE OPERATION OF A SERIES D.C. MOTOR WITH INCREASE OF APPLIED VOLTAGE.
V.Corlăţeanu and Z.Murgu.
Bul. Inst. Politeh. Iasi, Vol. 5(IX), No. 1-2, 277-90 (1959). In Roumanian.

The steady-state and transient behaviour of a series d.c. motor was studied for increase of applied voltage. The parameters of the machine which determine its mode of operation were considered, together with the operation of a motor with constant load or at constant speed. The factors which limit the extent to which the applied voltage can be increased, such as heating, commutation losses, and mechanical considerations are discussed.

621.313.236.3

7163 MULTIPOLE THREE-STAGE MACHINE AMPLIFIERS. F.Andrzejewski.
Arch. elektrotech. (Warsaw), Vol. 8, No. 3, 403-32 (1959). In Polish, with summaries (2 pp. each) in Russian and German.

The advantage of the 3-stage amplifier consists in increasing the output without lowering the sensitivity of regulation and without increasing the time-constant. The influence of number of poles, of the split excitation-winding in the third stage and of the ratio between the number of excitation turns and that of the armature bars upon the output, amplification factor, time-constant and figure of merit is analysed. A.Karlsbad

621.313.3 : 621.52

7164 REDUCTION OF ERROR AND NULL VOLTAGE IN SYNCHRO CONTROL SYSTEMS.
C.Lang and C.Smith.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1844-51 (1960) = Pwr Apparatus Syst., No. 46 (Feb., 1960).

It is pointed out that the greatest error in synchro control systems is due to manufacturing tolerances in the synchros themselves. The synchro-error and null-voltage equations are derived and the relations between parameters are deduced for which perfect balance conditions exist. Thus it is shown that introduction of additional resistances and/or capacitances into the windings or their connections leads to reduction in the error voltages. Theoretical and empirical determination of these components is dealt with. T. Horrocks

621.313.3

7165 END COMPONENT OF ZERO-SEQUENCE REACTANCE OF A.C. MACHINES. R.T.Smith.
Trans Amer. Inst. Elect. Engrs III, Vol. 79, 259-64 (1960) = Pwr Apparatus Syst., No. 48 (June, 1960).

Formulae are developed for calculating the end component of zero-sequence reactance of 3-ph. a.c. machines. The total zero-sequence reactance is then found by adding to the end component the reactance associated with the stacked portion of the machine, formulae for the latter component having been previously given in the literature. Two formulae are obtained, one for 120° belts and one for 60° belts. Test information and calculations are limited to 400 c/s aircraft generators. A simplified equation for 120° belts showed good agreement with tests and the influence of saturation was found to be very small. R.Hawley

621.313.32

7166 CALCULATION OF THE TRANSIENT TORQUES DURING INCORRECT SYNCHRONIZATION AND SHORT-CIRCUIT OF A SYNCHRONOUS MACHINE. G.Calvi.
Elektrotech. u. Maschinenbau (E.u.M.), Vol. 77, No. 18, 407-11 (Sept. 15, 1960). In German.

Simple equations are derived for the peak, transient air-gap torques on synchronous machines after the first half-cycle following incorrect synchronization and short-circuit. Three-phase, single-phase line-to-line and single-phase line-to-neutral faults are considered. Although the equations are based on a number of simplifying assumptions it is claimed that the results are sufficiently accurate for the mechanical design of shafts and foundations. H.Sterling

621.313.32

7167 EXCITATION AND REGULATION OF LARGE SYNCHRONOUS MACHINES BY MEANS OF RECTIFIERS. K.P.Haamann.
Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 9, 317-23 (April 25, 1960). In German.

A discussion of the advantages of the method over the exciter method. Comparative tests are given for a 46.7 MVA plant with the 2 methods. The response obtainable is described and it is shown that a machine with rectifier can be run in parallel with several machines having exciters. An electronically excited synchronous capacitor can be used for wattless-load regulation. The effect of the damping winding on voltage regulation is described. A bibliography is added. R.G.Jakeman

621.313.32

7168 AN OSCILLATING SYNCHRONOUS LINEAR MACHINE. E.R.Laithwaite and R.S.Mamak.
Proc. Instn Elect. Engrs, Paper 3351 U, publ. Nov., 1960, 12 pp. To be republished in Vol. 108 A (1961).

Describes the development of a new type of a.c. generator in which the moving member travels between a d.c. pole structure in a straight line with reciprocating motion. The induced e.m.f. appears in the moving member, which consists of a single loop of conducting material which embraces and moves along the core. The core carries stationary coils which experience an induced alternating e.m.f. by transformer action from the moving loop. These coils are not associated with the air-gap between the d.c. poles and are more easily cooled than the windings of a rotary machine. The loop, which is confined to the air-gap, can be run at high temperature, since it carries no insulation. The machine can be used as a generator to convert mechanical power supplied directly from a piston. It can also be used as a synchronous motor for such purposes as the driving of compressors without cranks; when used in this manner the machine is self-starting. Essentially a single-phase machine, this equivalent of multi-polar rotary machines can be constructed which will generate e.m.f.'s at 50 c/s with mechanical oscillations at frequencies lower than 3000 per minute. The construction of the machine is simple, since the core is made up entirely from rectangular stampings while the windings consist of four transformer-type coils and a conducting loop. An experimental machine is described, development of which consisted largely of testing devices to minimize the internal impedance. Test results are given. A proposed design for a 33 kVA generator is included.

621.313.32

7169 LOAD STUDY OF PARALLEL ACTING SYNCHRONOUS MACHINES BY TENSOR METHOD-I. N.Sinharay.
J. Assoc. Appl. Physicists, Vol. 5, 40-54 (1956).

Presents a new method for calculating the performance characteristics of two synchronous machines acting in parallel with a load impedance connected across the common bus. The method is algebraic in nature and based on tensorial concepts as applied to rotating electrical machines. With a slight modification the method can be extended to the case of n-machines using actual values of machine constants.

621.313.322

7170 THE TECHNICAL DEVELOPMENTS OF LARGE TURBO-ALTERNATORS AND ESPECIALLY COOLING PROBLEMS. A.Wolfhügel.
Bull. Soc. Franc. Elect., (Ser. 8), Vol. 1, No. 7, 448-61 (July, 1960). In French.

A review of the improvements attained in recent years with the object of increasing the output of units. Comparisons are made of various types of cooling, including internal cooling of the conductors

by gas, water, or steam. It is anticipated that outputs above 625 MVA will be possible in the near future. A bibliography is added.
R.G.Jakeman

621.313.322

7171 EXCITATION OF SYNCHRONOUS ALTERNATORS WITH MOTOR-EXCITER SET, AUXILIARY BATTERY AND METAL RECTIFIER. K.Schydlo.
Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 11, 385-7 (May 23, 1960). In German.

Where alternators are excited from motor-exciter sets which are supplied from the alternator output, special methods must be adopted to initiate excitation. Proposals for feeding the alternator field initially from an auxiliary battery via a metal rectifier are presented with hints about the size of these components. The build-up and transfer of excitation is automatic and requires no switching. Tests on series and parallel connections are presented with the help of oscillograms. H.Sterling

621.313.322

7172 HIGH-VOLTAGE ALTERNATORS WITHOUT EXCITER. W.Föhse.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 15, 366-8 (July 25, 1960). In German.

A self-exciting 6.6 kV machine with 520 kVA output is described. The arrangement differs from the schemes for lower voltages mainly through the use of a transformer to feed the excitation circuit and the employment of silicon rectifiers. The system is suitable for a double-voltage machine. P.Linton

621.313.322

7173 APPROXIMATE GRAPHICAL SOLUTION OF THE END FIELD OF AN ALTERNATOR WITH MAGNETIC ROTOR END-BELL. M.Kotal.
Elektrie, Vol. 14, No. 5, 183-8 (May, 1960). In German.

An approximate solution of the screening effect of magnetic rotor end-bells on turbo-alternators is presented in some detail. Flux-plotting methods are used and flux-plots of the stator and rotor endwinding space illustrate the influence of various factors on the flux pattern. It is shown how flux-plotting methods can be used to solve complex magnetic-circuit problems. H.Sterling

621.313.322

7174 COMPOUNDED SYNCHRONOUS GENERATORS. G.Bader and A.Otto.
Elektrie, Vol. 14, No. 7, 247-52 (July, 1960). In German.

After outlining the advantages and describing various systems of compounding synchronous generators, a new method for rotating field types is given which employs rotating current-transformers; test results on one such generator are given. Parallel running and the starting surges due to direct-switching of squirrel-cage motors of comparable rating to the generator are considered. There is an extensive bibliography. J.T.Hayden

621.313.322-8

7175 LARGE TURBO-ALTERNATORS WITH INTERNALLY-COOLED CONDUCTORS. M.Baylac.
Bull. Soc. Franc. Elect., Vol. 1, No. 7, 462-9 (July, 1960). In French.

A review of the construction of stator and rotor windings with internal cooling of the conductors. It is shown that this method uses the material more effectively than any other system. The problem of terminals is discussed. Mention is made of the H seal and of excitation by means of a direct-coupled alternator and silicon rectifiers. R.G.Jakeman

621.313.322-81

7176 SHEARING OF THE SHOULDERS OF ROTOR SPOKES IN A HYDRO-GENERATOR.
B.A.Kartashkin and Yu.M.El'kind.
Elekt. Stantsii, 1960, No. 1, 41-6 (Jan.). In Russian.

A number of mechanical faults, including shearing of the shoulders of the rotor spokes, were detected in 1948 in an ASEA 22.5 MVA umbrella-type hydro-generator. The cause was vibration of the rotor rim and its displacement by 2.5-3 mm in the axial direction relative to the spokes. A description is given of the general design of the section affected, and of investigations carried out. It is shown that the axial asymmetry of the air gap causes alternating forces which, superimposed on the constant forces, are the main cause of displacement of the rim relative to the spokes and thus of the shearing which arises.
Associated Electrical Industries (Manchester)

621.313.322-81

7177 CONVERSION OF TURBO-GENERATORS TO OPERATION WITH INCREASED HYDROGEN PRESSURE.
R.A.Marinov and D.G.Speranskii.
Elekt. Stantsii, 1960, No. 1, 81-2 (Jan.). In Russian.

A description is given of alterations made to the structure of TV2-100-2 turbo-generators for converting them for operation with a higher hydrogen pressure. The main alterations were: carefully sealing the generator housing, adjusting the surface of the joint, and reducing the clearance in the gland bearings from 0.2-0.3 mm to 0.1 mm. In this way, it was possible to reduce the leakage at a hydrogen pressure of 0.5 atm to 3-4 mm Hg. At a pressure of 0.05 atm and a cooling gas temperature of 30 and 40° C the maximum rotor currents were 627 and 603 A; under the same conditions but with a pressure of 0.5 atm, they were 676 and 635 A respectively. It is stated that no complicated alterations were required.
Associated Electrical Industries (Manchester)

621.313.322-81

7178 MEANS OF EXTENDING THE OUTPUT LIMITS OF LARGE WATERWHEEL ALTERNATORS. L.Carpentier.
Rev. gen. Elect., Vol. 69, No. 6, 317-25 (June, 1960). In French.

A review of the principal design problems which limit the output and indications as to how these limits may be extended. Electrical problems include dimensioning of the stator and its winding, optimum proportions of the rotor and ventilation. Mechanical problems include overspeed stresses and problems entailed by size and weight of the poles. R.G.Jakeman

621.313.322-81

7179 SHORT-CIRCUIT TORQUES IN TURBINE GENERATORS. P.I.Nippes.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1677-83 (1960) + Pwr Apparatus Syst., No. 46 (Feb., 1960).

Approximate solutions to the problem of torsional shaft stresses in turbine generators resulting from electrical disturbances at the generator are described. These have been obtained by methods of analysis and a series of computer studies. The rotating systems discussed have 1, 2 and 3 degrees of freedom are represented as concentrated masses connected by inertialess springs. Non-salient-pole type generators only are considered. G.V.Hargreaves

621.313.322-81

7180 THE ECONOMICS OF VERY LARGE TURBINE GENERATOR UNITS. J.R.Carlson.
Westinghouse Engr, Vol, 20, No. 4, 111-15 (July, 1960).

An examination into the economics of the total plant having the following machine units: (1) one 800 MW unit, (2) one 600 MW, (3) two 400 MW, (4) four 600 MW, (5) three 800 MW. In each case, cross-compound turbines are considered. Comparative tables are given for (1) heat rates, (2) capital cost estimates, (3) calculated energy costs. It is concluded that energy costs can be reduced by installing larger and larger turbo-generator units, at least up to 800 MW. R.G.Jakeman

621.313.322-82

7181 EFFICIENCY MEASUREMENT BY THE CALORIMETER METHOD AND THE APPLICATION OF THE SAME FOR THE YBBS–PERSENBEUG POWER STATION GENERATORS. K.Bitter.
Elin-Z., Vol. 12, No. 2, 71-80 (June, 1960). In German.

The large dimensions of many waterwheel generators make assembly for testing in the manufacturer's works difficult or even impossible. The determination of individual losses by the wattmeter method is not always accurate, particularly for umbrella-type machines where the thrust and guide bearing and windage losses of the turbine have to be estimated and deducted from the measured values. Manufacturers are therefore tending to favour calormetric methods of loss determination, especially when the generator is to be tested at site. Calorimetric loss measurement can be carried out directly or by a comparative method, in which latter case radiation and kinetic energy losses need not be taken into consideration. In both cases four test runs are made, namely no-load, short circuit, full load and unexcited no-load runs. Measurements and calculations made on generator No. 5 of the Ybbs–Persenbeug power station are quoted as an example of the direct procedure.
A.S.Hay

621.313.322-82

7182 AN UNUSUAL METHOD FOR REPLACING A ROTOR SPIDER IN A WATER-WHEEL GENERATOR.
W.R.Small, Jr and P.M.Bell.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1469-73 (1960) = Pwr Apparatus Syst., No. 46 (Feb., 1960).

When cracks were found in the hub of the spider of a 15 MVA 60c/s 94.7 rev/min water-wheel alternator, it was decided to press out the old spider, expand the rim with heat and pull a new spider into place. The planning and progress of this work are described in detail. R.G.Jakeman

621.313.323

7183 A NEW BRUSHLESS D.C. EXCITED ROTATING FIELD SYNCHRONOUS MOTOR. G.M.Rosenberry.
Trans Amer. Inst. Elect. Engrs II, Vol. 79, 136-9 (1960) = Applic. and Industr., No. 49 (July, 1960).

Describes the operation and performance of the motor in which all sliding and mechanical-type contacts have been eliminated by the use of high-current silicon controlled-rectifiers. Starting is similar to a squirrel-cage induction motor, the synchronising function and pull-out protection being automatically provided by a simple static circuit of two silicon controlled-rectifiers and zener diodes. Power factor adjustment is retained. Tests results on a 50 h.p. motor are given, and in the short discussion, further possible advantages of the motor are suggested. J.T.Hayden

621.313.325

7184 SOME CAUSES OF INCREASED VIBRATIONS IN SYNCHRONOUS MULTIPOLE MACHINES. V.Yu.Avrukh.
Elekt. Stantsii, 1960, No. 1, 38-41 (Jan.). In Russian.

In many salient-pole synchronous machines, vibrations in the bearings sometimes change with an alteration in the load. Among the most frequent causes of such vibrations are inter-turn short-circuits and uneven air gaps. An analysis of these causes in respect of synchronous condensers on the basis of the results of experiments and calculation is given. It is shown that vibration can be temporarily eliminated by dynamic balancing. To ensure vibration-free operation, accurate radial positioning of the poles must be guaranteed. This will ensure a uniform gap between all the poles and the stator body. The tolerances in the radial position of the poles should not exceed 2-3% of the size of the air gap.
Associated Electrical Industries (Manchester)

621.313.33

7185 THE MORE EXACT CALCULATION OF THE MAGNETISING CURRENT OF THREE-PHASE ASYNCHRONOUS MACHINES. K.Oberreti.
Bull. Oerlikon, No. 335, 66-84 (Aug., 1959).

An exact, though rather laborious, calculation of the magnetic circuit of an asynchronous machine to determine the magnetizing current is justifiable if it leads to a more economic design. Curves are published which will assist in the more exact determination of the magnetomotive forces in the teeth, air gap and yokes; yoke relief due to the effect of teeth, slots and shaft has been considered. The results of measurements are quoted to permit an assessment of the effect of machining (cutting or punching of laminations) on the permeability of small, laminated components as, for example, the teeth. The effect of the yoke magnetomotive force on the flattening of the field distribution curve is discussed. It is shown that the magnetizing current of star-connected machines can be determined from the fundamental of the field excitation, and also that the increase of the wattless current of delta-connected machines, particularly those with squirrel-cage rotors, is inconsiderable. Possible sources of errors are discussed to help explain any possible differences between measured and calculated values.

621.313.33

7186 THE BEHAVIOUR OF A THREE-PHASE ASYNCHRONOUS MOTOR HAVING ASYMMETRICAL RESISTANCES IN THE STATOR CIRCUIT. N.V.Boţan, V.Prisăcaru and B.Ponomarev.
Bul. Inst. (Politeh). Iasi, Vol. 5(IX), No. 1-2 271-6 (1959). In Roumanian.

621.313.33

7187 A.C. MOTORS IN SHIPS. J.C.H.Bone.
Elect. Times, Vol. 138, 125-8 (July 28, 1960).

A review of available types and their applications. The properties of squirrel-cage motors are discussed, together with a.c. commutator motors for the cases when variable speed is required. Considerations governing the choice of motors are explained. R.G.Jakeman

621.313.33

7188 EXCITATION SCHEMES OF VARIABLE FREQUENCY ASYNCHRONOUS GENERATORS.
A.T.Golovan and I.M.Kruglyanskii.
Elektrichestvo, 1960, No. 5, 31-6 (May). In Russian.

A number of schemes are analysed, which involve the introduction of capacitance and additional resistance into the rotor and stator circuits of the generator, in order to give smooth regulation of frequency over as large a range as possible. The final scheme quoted is, in effect, a combination of three schemes covering restricted frequency "bands", and is capable of providing a range of regulation of 10-15 by means of variable resistors. The capacitance found to be necessary for the excitation of a 1.7 kW machine for maximum range of frequency is 450-500 μF although, for more restricted frequency ranges, considerably smaller values are quoted. J.H.B.Gould

621.313.33

7189 RELATIVE CHARACTERISTICS OF ASYNCHRONOUS MACHINES. V.M.Kutsevalov.
Elecktrichestvo, 1960, No. 6, 47-50 (June). In Russian.

Presents the generalized equations of asynchronous machines, relative to the mechanical, rotor-currents and excitation-current characteristics for any degree of slip under two main operating conditions (a) constant voltage (b) constant current. The general equation corresponding to the mechanical characteristic is similar in form to Kloss's equations and the latter appears to be a particular case of the general equation. The other particular cases of the general equations relating to mechanical characteristics appear to be equations for various machines such as those with heavy rotors. A table is given for calculation of the component parts of the general equation under constant voltage and current conditions for such cases as critical turning moments. J.S.Wilson

621.313.332 : 621.316.1

7190 THE ATTAINMENT OF FIELD SYMMETRY IN A THREE-PHASE, ASYNCHRONOUS MACHINE IN A SINGLE-PHASE NETWORK OF VOLTAGE $2V_{\phi\text{-}N}$. N.I.Chernopyatov.
Bul. Inst. Politeh. Iasi, (Ser. nouă), Vol. 5(9), No. 1-2, 265-70 (1959). In Russian.

A scheme is analysed whereby a symmetrical rotating field can be obtained in a three-phase machine working on a single-phase network at twice its rated phase voltage. The machine windings, which are connected in series, are shunted by three complex admittances in the manner A, B, BC. To arrive at the values of the admittances to obtain symmetry it is sufficient to know the parameters of the machine in the three-phase condition. A change of load on the machine must lead to a change in the balancing parameters sufficient to maintain the circular field. With machines operating in the motoring regime having $\cos\phi = 0.8$ to $\sqrt{3}/2$, the balancing parameters must be purely reactive, the machine efficiency in this case being on a level with that attained when working on a three-phase network. J.H.B.Gould

621.313.333

7191 SINGLE-PHASING THREE-PHASE MOTORS. R.C.Moore.
Allis-Chalmers elect. Rev., Vol. 24, No. 4, 20-4 (4th Qtr., 1959).

Characteristics are derived by simulating the 1-ph. operation by a 2-motor drive in which the stator windings of the two 3-ph. motors are connected in series, one in positive and the other in negative sequence. Test results are given. A short bibliography is added. R.G.Jakeman

621.313.333

7192 ESTIMATION OF THE ECONOMIC VALUE OF A 3-PH. INDUCTION MOTOR. H.Widowiak.
Arch. elektrotech. (Warsaw), Vol. 8, No. 2, 217-57 (1959). In Polish, with summaries (3½ pp.) in Russian and (6½ pp.) in English.

Taking into account the cost of the motor, the current prices of electric energy and of materials (copper and magnetic steel) and the rate of exchange, indices are introduced, characterizing the cost of utilization of the motor and its "economic efficiency", the latter being influenced by the power-factor. A method is described which permits, for given requirements, the selection of the best design of the motor for obtaining the lowest running costs. A numerical example is calculated for two different motors and in each case for two different utilization periods. A.Karlsbad

621.313.333

7193 THE RELATIONSHIP OF THE REACTIVE POWER IN SINGLE-PHASE CAPACITOR MOTORS WITH THREE-PHASE STATOR WINDINGS. A.I.Adamenko.
Elektrichestvo, 1960, No. 6, 61-9 (June). In Russian.

Discusses various schemes of connection of single-phase motors with three-phase stator windings in which revolving magnetic fields in the air gap can be obtained by using external reactances for any arrangement of the phases of the motor. The relationship of the parameters is given in tabular form for seven different schemes of connection. The characteristic features of each circuit are briefly described and comparison made with motors having two-phase stator windings. A few examples are given where the described type of motor offers operating or economic advantages.
J.S.Wilson

621.313.333

7194 THE THERMAL AND DYNAMIC ENERGY CONVERSION IN ASYNCHRONOUS ROTORS. J.Sittner.
Elektrie, Vol. 14, No. 7, 239-45 (July, 1960). In German.

Develops an approximate method for predicting the energy in the rotor, the run-up time and the mean temperature rises of the rotor core, conductor bars and end rings during the run-up period of cage-rotor (including double-cage) induction motors started by direct switching. The expressions derived are applied to a 170 kW motor by way of example. The rating and recommended temperature rises for motors in direct-switching applications are discussed, and a short bibliography is included.
J.T.Hayden

621.313.333

7195 COMPENSATED INDUCTION MOTOR. J.Kucera.
Rev. gen. Elect., Vol. 69, No. 8, 425-33 (Aug., 1960). In French.

A 3-ph. induction motor has 2 separate stator windings, one connected to the supply and the other to a bank of capacitors. The characteristics are developed analytically, employing matrix algebra. A numerical example is included.
R.G.Jakeman

621.313.333

7196 EQUATIONS FOR INDUCTION MOTOR SLIP. V.B.Honsinger.
Trans Amer. Inst. Elect. Engrs III, Vol. 78,1621-6 (1960) = Pwr Apparatus Syst., No. 46 (Feb., 1960).

These equations may be derived by the simultaneous solution of five basic equations: torque; developed power; true motor output; slip; secondary current for which 5 variations are given. The results are shown to be simple and accurate. A discussion is added.
R.G.Jakeman

621.313.333

7197 ACCELERATION CHARACTERISTICS OF SQUIRREL-CAGE MOTORS. R.L.Nailen.
Westinghouse Engr, Vol. 20, No. 2, 41-3 (1960).

A review of the mechanical and heating stresses which may occur when starting various types of drive. Curves of temperature build-up in stator and rotor for different values of inertia are given.
R.G.Jakeman

621.313.333.1

7198 TRANSIENT BEHAVIOUR OF THE THREE-PHASE SLIPRING ROTOR. I-II. L.Hannakam.
Regelungstechnik, Vol. 7, No. 11, 393-8; No. 12, 421-7 (1959). In German.

The electromechanical equations of a slipring rotor which forms the controlled device in a control loop are presented. They are simplified with the help of a transformation which treats the slipring rotor as two direct-current armatures. The resulting equations are suitable for feeding into commercial analogue computers. In the second part, the block diagram, based on the electromechanical equations of the system, is given and simplified for some special conditions, such as small values of slip and slight deviations from a steady-state zero position. Methods for obtaining the system parameters from tests on the machine are described. A practical example of fast acceleration to full speed illustrates the typical transient behaviour of slipring induction motors with the help of speed–time and torque–time curves.
H.Sterling

621.313.333.2

7199 RELATION BETWEEN COIL CHORDING AND ROTOR SLOT NUMBERS OF SINGLE-SPEED AND MULTI-SPEED SQUIRREL CAGE MOTORS. T.Torda.
J. Instn Engrs Australia, Vol. 32, No. 1-2, 7-10 (Jan.-Feb., 1960).

Describes a method of determining the favourable rotor slot numbers corresponding to the so-called "conventional" chording of single-speed squirrel cage motors. It is a well-known practice, in designing pole-change motors with the speed ratio two to one, to apply a double-layer stator winding with a coil pitch which is equal to the pole pitch of the larger pole number. Experience has shown that in many cases the rotor slot numbers, ranging between the permissible maximum and minimum values, and combined with the above specified coil pitch, produce good features for one of the pole numbers. A simple method is described selecting such a coil pitch and such a rotor slot number, that they will produce smooth torque–speed characteristics and low magnetic sound levels for both of the pole numbers, be they in the ratio two to one, three to one or an improper fraction to one. The test data of standard as well as of experimental squirrel-range motors of the single-speed and of the multi-speed types is quoted and their agreement with the empirical rules is shown.

621.313.361

7200 QUANTITATIVE TREATMENT OF THREE-PHASE BRUSH-SHIFTING SERIES COMMUTATOR MOTOR. O.E.Mainer.
Proc. Instn Elect. Engrs, Mongr. 413 U, publ. Nov., 1960, 7 pp. To be republished in Part C.

Previous quantitative treatments appear to have ignored the loss component of motor current. In this paper an approximate equivalent circuit, which makes allowance for this component, is developed from first principles. A method is devised for correcting the errors introduced by the approximate treatment so as to obtain an accurate solution. The average percentage errors in motor current, power factor and input obtained by both approximate and accurate treatments are given for a wide range of operating conditions.

TRANSFORMERS

621.314.2

7201 CONTRIBUTION TO THE CALCULATION OF HEATING IN TEST TRANSFORMERS. G.Senft.
Arch. electrotech. (Berlin), Vol. 44, No. 6, 363-72 (1959). In German.

The differential equation for the thermal conditions in a layer-wound transformer is derived from the equivalent R–C circuit representing the losses in the conductors and in the interlayer insulation. The conditions arising with variable load and during cooling are particularly considered.
J.H.Mason

621.314.2

7202 SOLVING MULTI-WINDING TRANSFORMER CIRCUIT PROBLEMS. A.H.Knable.
Allis-Chalmers elect. Rev., Vol. 24, No. 4, 30-5 (4th Qtr, 1960).

A demonstration that seemingly difficult transformer problems involving complex windings can be solved by reference to the basic transformer equations. Five practical examples are given and the method of calculation is set out with great clarity.
D.R.Way

621.314.2

7203 A NEW METHOD OF CALCULATING COIL VOLTAGES BASED ON THE WAVE REPRESENTATION OF POTENTIAL OSCILLATIONS WITHIN THE TRANSFORMER WINDING TAKING INTO CONSIDERATION THE REFLECTED WAVES. P.Ciechanowicz.
Arch. elektrotech. (Warsaw), Vol. 8, No. 1, 63-79 (1959). In Polish.

The method is based on potential distribution along transformer winding $u(x,t)$ resulting from application of a rectangular impulse wave. The difference of potential $g(x,t)$ at any section of the winding D is taken as $g(x,t) = u(x,t) - u(x + D,t)$. This potential difference is considered in a wave representation taking into account simultaneously the waves reflected from both ends of the winding. The method is linked inseparably with the initial and the final potential distribution which can be determined from self-capacitance and capacitance-to-ground of the transformer winding. Exact and simplified expressions are obtained for transformer windings with neutral point both earthed and insulated. Homogeneous and heterogeneous windings are considered. An example of graphical representation of results is given.
W.J.Grek

621.314.2

7204 ALUMINIUM STRIP WINDINGS. B.H.J.Rata and J.S.Haggitt.
Elect. Times, Vol. 137, 999-1002 (June 23, 1960).

The advantages and winding techniques of aluminium strip windings are considered, using paper, Melinex, and anodizing to provide insulation. Details are given of joining methods, together with notes on the design of strip-wound coils. M.R.Dickson

621.314.2 : 621.316.13

7205 DETERMINATION OF ECONOMIC PERFORMANCE CONDITIONS FOR TRANSFORMERS CONNECTED INTO A TRANSFORMER–LINE SYSTEM. V.V.Mikhailov.
Elekt. Stantsii, 1959, No. 12, 41-2 (Dec.). In Russian.

For the purpose of studying the conditions of economic performance and determining, for a given load, which transformers should be connected or what number to choose, assuming direct connection to the substation busbars, account is taken of the line losses for two transformers of different powers and lines of different area cross-section. Relationships are derived for categorizing the principal losses as between transformers and line, and for determining the optimum load conditions for change-over from one transformer to two. An example is worked for two 20 MVA transformers connected to a 60 km transmission line operating on 110 kV with a resistance of 0.33 Ω/km. R.Matthews

621.314.2

7206 MODEL AND TESTING OF A VERY HIGH-VOLTAGE TRANSFORMER WITH PACKED INSULATION. J.Valeš, J.Kopeček and B.Hrbek.
Elektrotech. Obzor, Vol. 49, No. 7, 350-6 (1960). In Czech.

For the testing of the insulation and the short-circuit safety of max. high-voltage transformers a full size 420 kV model was built. The model was for 53 MVA, single phase, and the insulation was made of oil-impregnated paper. Results of the tests are described. N.Klein

621.314.2 : 621.316.1

7207 THE EQUIVALENT CIRCUIT OF TRANSFORMERS IN ELECTRONIC NETWORK CALCULATIONS. H.Dommel.
Elektrizitätswirtschaft, Vol. 59, No. 9, 271-5 (May 20, 1960). In German.

The equivalent π circuit for a two-winding transformer is based on the N_{sw}-potential method [Abstr. 3774 of 1956 and 3399 of 1957]. The case of "off-nominal" turns ratio is considered and illustrated by means of a numerical example. The method is extended to three- and four-winding transformers. A.K.Podkolinski

621.314.2

7208 SURGE TRANSFORMER FOR GENERATING HIGH VOLTAGE IMPULSES. F.Früngel.
Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 10, 355-60 (May 9, 1960). In German.

Surge transformers, as distinct from impulse transformers, are designed to generate as well as transform an impulse wave. The design described delivers a non-oscillatory power surge at any desired voltage. A well insulated laminated core is used as it has superior field-dispersion characteristics to a ferrite or wire core. It is not necessary to have a closed magnetic circuit, which results in a considerable space saving. A surge transformer capable of delivering a standard 500 kV surge wave to a test object of up to 5000 pF capacitance is described. The same principles have been used in the design of a repetition surge transformer for thermodynamic investigations. A.S.Hay

621.314.2

7209 HIGH-POWER TRANSFORMERS. J.Kreuzer.
Elin-Z., Vol. 12, No. 2, 90-101 (June, 1960). In German.

The design of a transformer is governed by four basic equations containing five variables. The most economical design can be produced by introducing the ratio between iron and copper weights as parameter. The rating of a transformer is of secondary importance as a measure of the type size compared with the product of the percentage iron and copper losses. When a range of transformers is planned, it is advantageous to chose the induction and current density as invariable quantites. Once an optimum design has been made for a particular rating, designs for other transformers in the same range are derived from it. The impedance voltage of a transformer can have a marked influence on the price if the losses are to remain unaltered. It is therefore advisable to leave the impedance voltage open in tender specifications unless parallel operation is required. It is also inadvisable to prescribe absolute loss figures as the price increase thereby produced may exceed the gain obtained from reduced capitalization charges. A.S.Hay

621.314.2

7210 THE DILUTION OF INITIAL PERMEABILITY IN CORES OF ALTERNATELY INTERLEAVED LAMINATIONS. R.Brenner and F.Pfeifer.
Frequenz, Vol. 14, No. 5, 167-81 (May, 1960). In German.

Unavoidable gaps in an assembled laminated core, in a particularly drastic case, may reduce the permeability by 95%. The distribution of magnetic flux in a laminated core is discussed. Components of the magnetic reluctance are calculated, viz. material itself, overlap from lamination to lamination assuming a complete flux transition and uniform cross-section or enlarged ends, magnetic shunt with E and I cores. As examples of calculation of the diluted permeability the following cases are considered: symmetrical M-cores, EE-cores, U-cores, I-cores. Experimental and theoretical values of the permeability are compared. Limits of application of the formulae are discussed. Dilution curves are given for various types of standard German laminations. J.M.Silberstein

621.314.2

7211 SINUSOIDAL AND NON-SINUSOIDAL CIRCULATING CURRENTS IN THE PARALLEL OPERATION OF N TRANSFORMERS WITH DIFFERENT PARAMETERS. I.S.Gheorghiu.
Rev. gen. Elect., Vol. 69, No. 6, 339-51 (June, 1960). In French.

An analytical examination into the parallel operation of any number of transformers. The effects are considered of inequality of ratio and of magnetizing current, difference in type of construction, saturation, different methods of connection, different leakage coefficients. The most unfavourable conditions are enumerated. A short bibliography is added. R.G.Jakeman

621.314.2

7212 THE EDDY CURRENT LOSS DUE TO THE RADIAL FIELD IN SYMMETRICAL CIRCULAR COILS. C.E.M.de Kuyper.
Smit Meded., Vol. 15, No. 2, 29-33 (April-June, 1960). In Dutch.

By analogy with the critical width of the copper in the axial leakage field, the critical height of the copper in the radial field of a symmetrical winding is calculated. It is proved that, provided the reduced height of the copper is less than the critical height, the redistribution of the flux by the eddy currents can be ignored. Then the eddy-current loss caused by the radial field can be calculated by simple formulae. For large transformers the reduction of the height of the conductors needed to reduce the eddy-current loss complicates the design of the windings, and for high-voltage windings affects the space factor unfavourably unless prefabricated stranded conductors are used. 8 references. E.F.Hansford

621.314.2

7213 SOME CHARACTERISTICS OF AUDIBLE NOISE OF POWER TRANSFORMERS AND THEIR RELATIONSHIP TO AUDIBILITY CRITERIA AND NOISE ORDINANCES. M.W.Schulz and R.J.Ringlee.
Trans Amer. Inst. Elect. Engrs III, Vol. 79, 316-23 (1960) = Pwr Apparatus Syst., No. 48 (June, 1960).

Several audibility criteria are discussed; methods are summarized for predicting the degree of annoyance to the public of a given noise, and simplifications are proposed in applications to transformer noise. Statistics of transformer noise are published, obtained from measurements on 36 transformers from 5 to 200 MVA rating, and some consideration is given to calculation of noise level at a distance from a transformer. M.R.Dickson

621.314.2 : 621.372.412

7214 PIEZOELECTRIC VOLTAGE TRANSFORMERS. A.E.Crawford.
Wireless Wld, Vol. 66, No. 10, 510-14 (Oct., 1960).

The basic operating principles and construction of ring, transverse and hybrid electromechanical transformers using isotropic lead zirconate titanate ceramics are described. Design considerations are stated and experimental results for the transverse type (where the input and output electrodes are orthogonal) which appear to offer immediate promise are given (gains of unity to 500 and operating frequencies of 20-100 kc/s being possible). A transformer operating at a fundamental frequency of 40 kc/s with mechanically identical input and output sections had an input impedance of 750 ohms and a gain which varied between 50 and 40 for

input voltages between 5 and 10 V. Suggested applications include high-voltage power supplies and high-voltage pulse generation, the main advantages claimed are absence of magnetic field, elimination of insulation problems, light weight, and simple high-frequency operation. A.P.C.Thiele

621.314.2 : 621.313.1

DETERMINATION OF TEMPERATURE RISE IN TRANSFORMERS. See Abstr. 7147

621.314.21

7215 LINE AND NEUTRAL CURRENTS IN MULTI-LIMB TRANSFORMERS UNDER IMPULSE-TEST CONDITIONS. E.L.White.

Rep. Brit. Elect. Res. Assoc., Rep. S/T97, 17 pp. + 18 pp. figs (1959).

Terminal currents in two-limb and three-limb transformers under impulse test are analysed with a view to selecting the most suitable current to record for fault detection and location. Proposed new recording circuits are shown by tests on a two-limb transformer to have high sensitivity to faults, though the location of faults from the line current remains unreliable.

621.314.21

7216 A NEW 1-MILLION VOLT TESTING TRANSFORMER WITH A LINEAR CORE. E.Schneider.

Rev. gen. Elect., Vol. 69, No. 6, 301-16 (June, 1960). In French.

This transformer uses a straight core without yokes, etc., the flux returning through air; the simple construction made possible by such a design is described. Field plots are shown of the electric and magnetic field distributions, and graphical methods used in the magnetic-circuit and leakage-reactance calculations are detailed. The construction of low- and high-voltage windings and of the capacitively divided insulation between windings is described, and also details are given of assembly and commissioning of the unit. M.R.Dickson

621.314.211

7217 SILICONE INSULATED DRY TRANSFORMERS. F.Nausch.

Elin-Z., Vol. 12, No. 2, 110-18 (June, 1960). In German.

The superiority of oil transformers over dry transformers lay in the past in the fact that the utilization expressed in W/kg was about 2.5 times higher. However, silicone insulated dry transformers can now be designed for practically the same utilization and can therefore compete favourably with oil transformers. In addition, they possess the advantages of lower fire risk, reduced maintenance and higher overload capacity. The economical upper voltage and power limits for silicone insulated transformers are 11.5 kV and 1.5 MVA. The construction of the core and windings is similar to that of oil transformers in principle. Silicone insulated transformers are particularly suitable where the ambient temperature is high and in mine installations. A.S.Hay

621.314.214

7218 300 kV MAIN AND 132 kV QUADRATURE BOOSTER REGULATING TRANSFORMERS FOR SOUTH AUSTRALIA. J.Müller and J.Kreuzer.

Elin-Z., Vol. 12, No. 2, 80-9 (June, 1960). In German.

The transformers, which are three-phase units, have an overall transformation ratio of 325 600....243 040/132 000 ± 16 × 3300 V and are rated at 60 MVA. They are of the core type with concentric windings. Type ON/OB cooling is provided. Protection against impulse voltages is achieved by the use of surge diverters and reinforcing the end-turn insulation on the high-voltage side of the main unit. Both ends of the regulating winding as well as its middle point are also protected by diverters. Electrostatic shielding is used to a large extent. A further point of interest is the connection of two diverters in series between the primary and secondary bushings of each phase of the booster unit, Jansen-type on-load tapchanging switches are used for both units. A.S.Hay

621.314.222/.224

7219 THE DEVELOPMENT OF INSTRUMENT TRANSFORMERS FOR EXTRA HIGH VOLTAGE WITH INCREASED DYNAMIC STRENGTHS. K.Walther, K.Wassermann, H.Bader and J.Christ.

Elektrie, Vol. 14, No. 7, 262-5 (July, 1960). In German.

Although an additional premagnetising winding would reduce the ratio error of a current transformer by moving the working range into a region of maximum permeability, this method has not been adopted because of practical difficulties. The use of an auxiliary core improved characteristics considerably but the general availability of cold-rolled transformer sheet has now made this unnecessary. Combined current and potential transformers are cheaper than separate transformers and are standard practice in new installations in East Germany. An essential requirement for good transformer performance is adequate dryness of the paper insulation, which is achieved by drying out the windings under high vacuum. A.S.Hay

621.314.223

7220 USE OF AUTOTRANSFORMERS IN POWER SYSTEMS. Yu.L.Gryuntal.

Energetik (Moscow), 1960, No. 8, 29-35. In Russian.

Describes some of the special features involved in the use of autotransformers in power systems. The basic principles of the autotransformer are outlined and the main technical terms explained. Some consideration is given to power autotransformers, parameters of autotransformers, special features of its application, operating conditions, calculation of losses, and voltage control. Associated Electrical Industries (Manchester).

POWER CONVERSION

621.314.5

7221 DESIGN OF A SATURABLE CORE POWER INVERTER. C.M.Bailey, Jr.

Proc. Nat. Electronics Conf., Vol. 15, 656-65 (1959).

The considerations involved in the design of a 100 W, 2600 c/s d.c. to a.c. transistor-core inverter power supply are discussed. A brief review is given of the simple inverter circuit and various modifications thereof, and a detailed discussion of the operation of the circuit selected for the application concerned with particular emphasis on achieving a reliable circuit design which is simplified and feasible for mass production.

621.314.5

7222 TRANSISTOR–CORE CONVERTER FOR HIGH INPUT VOLTAGES. R.P.Massey.

Proc. Nat. Electronics Conf., Vol. 15, 666-73 (1959).

Four-transistor bridge configurations for transistor–core convertors are described in which the maximum applicable input voltage and the maximum obtainable power output are twice that associated with conventional centre-tapped configurations using two transistors. Four-transistor bridge configurations may be extended to higher power output levels by at least two techniques that provide for equalized inverse voltages without appreciably sacrificing efficiency. These circuits permit conversion of the largest voltages now used in telephone plant. Certain simplifications of transistor bridge configurations are discussed.

621.314.5

7223 CONTROLLED D.C. TO D.C. VOLTAGE STEP-UP WITH A SINGLE TRANSISTOR. R.E.Morgan.

Proc. Nat. Electronics Conf., Vol. 15, 674-8 (1959).

A d.c. inverter is described that provides an output voltage greater than the input voltage. The output voltage is controllable and can be varied over a 10 : 1 voltage ratio. A single transistor and a saturable current transformer oscillate and control by a time-ratio control method. A single transistor can step up and control over 100 W.

621.314.5

7224 TRANSISTOR INVERTERS AND CONVERTERS. I - III. M.D.Berlock and H.Jefferson.

Wireless Wld, Vol. 66, No. 8, 399-402 (Aug.); No. 9, 461-5 (Sept.); No. 10, 507-9 (Oct., 1960).

In Pt I, the basic principle of the ringing-choke convertor is described, involving circuits using only one transistor to perform the sequential switching operation. Pt II describes the use of various two-transistor convertor circuits, starting difficulties and gives a number of practical circuits. The main drawback to this basic Uchrin–Royer circuit is the presence of collector current spikes involving the loss of overall efficiency. Pt III describes the Jensen circuit designed to overcome these difficulties by using two transformers, a small inexpensive saturable transformer in the base–emitter circuit initiating the switching operation, and the output transformer is a normal power transformer instead of the

large saturable transformer of the Uchrin–Royer circuit. Using a third clipping circuit leads to a frequency of operation less dependent on the transistors employed. A final requirement to improve this independence still further involves the use of a saturable reactor rather than a transformer. J.MacCormack

621.314.5 : 621.373.52

NEW HIGH POWER [TRANSISTORIZED] D.C. CONVERTER CIRCUITS. See Abstr. 6753

621.314.57

7225 **A GIROTRON WITH CONTROLLED GRIDS.** D.Teodoresku.

Elektrichestvo, 1960, No. 6, 68-70 (June). In Russian.

A girotron is a mercury-arc high-frequency convertor where rotation of the arc around a ring of radially situated anodes is induced by means of a vertical magnetic field. Operation of a girotron with non-controllable grids was described in an earlier paper. The control grids are fed through a phasing network from a sinusoidal supply or can be operated by pulse-shaped waveforms. The phase-angle is critical. The advantage of grid control lies in improved frequency stability against the load current and electromagnet induction. A possible range of operation of 500 c/s to 50 kc/s is claimed for girotrons at powers up to several megawatts with efficiencies approaching unity. In some cases these can be fed directly from three-phase mains. Z.A.A.Krajewski

621.314.57

7226 **ANALYSIS OF THE OPERATION OF SERIES-TYPE THYRATRON CONVERTORS.** A.E.Slukhotskii, A.S.Vasil'ev and V.M.Martsinovich.

Radiotekhnika i Elektronika, Vol. 4, No. 1, 63-9 (Jan., 1959). In Russian.

An analysis is given of the operation of series type thyratron convertors which can be used as current generators up to 30 kc/s. The conditions for obtaining a voltage curve near to sinusoidal across a resistive load for stable operation are determined. [English summary: PB 141f06T-12, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.]. R.C.Glass

621.314.58

7227 **STATIC INVERTER DELIVERS REGULATED 3-PHASE POWER.** M.Lilienstein.

Electronics, Vol. 33, No. 28, 55-9 (July 8, 1960).

A symmetrical Hartley oscillator feeds a 1.2 kc/s pulse into a six-transistor ring counter of three flip-flops. The ring counter supplies control signals in proper rotation to three s.c.r. switches, the voltage from which is raised from 26 to 150V in three single-phase transformers. The square-wave output is regulated by magnetic amplifiers before passing through harmonic filters, and an autotransformer connected in star corrects the angle between the three output phases to 120°. The operation of each part of the circuit is described, and some component values given. 7 references. E.F.Hansford

621.314.6

7228 **A TEST CIRCUIT FOR POWER RECTIFIERS.** G.I.Polyak and V.G.Golyatin.

Elektrichestvo, 1960, No. 3, 73-4 (March). In Russian.

The limitations of the conventional arrangement consisting in principle of two circuits, the current and the h.v. circuit, are considered. A new scheme including an additional oscillatory circuit to reproduce more accurately the voltage conditions arising in actual power rectifier installations is presented together with some oscillographic results. E.M.Dembinski

621.314.6 : 621.318.436.3

7229 **SATURABLE-REACTOR CONTROL OF FULL-WAVE AND BIPHASE RECTIFIERS.** J.B.Thomas and J.W.Drenning.

Trans Amer. Inst. Elect. Engrs III, Vol. 79, 36-9 (1960) = Commun. and Electronics, No. 47 (March, 1960).

Excessive voltages may occur in primary controlled saturable-reactor rectifier circuits particularly if unsymmetrical currents exist. These voltages can be minimized by paralleling the reactor with a dissipative element if small additional losses can be tolerated. A.J.Ingels

621.314.6 : 621.316.722

7230 **SERIES CAPACITORS APPLIED TO POWER RECTIFIERS.** L.J.Hibbard and T.J.Bliss.

Trans Amer. Inst. Elect. Engrs II, Vol. 79, 75-84 (1960) = Applic. and Industr., No. 48 (May, 1960).

Shows that series capacitors may significantly reduce the voltage regulation at the terminals of a d.c. inductive load fed by a single-phase power rectifier. Results are given of a theoretical analysis, of a laboratory study using analogue circuitry, and of full scale laboratory experiments. The effect of the capacitor on the peak inverse voltages applied to the rectifier is considered, and recommendations are made for the capacitor rating and protection. 6 references. E.F.Hansford

621.314.62

7231 **MECHANICAL RECTIFIER DEFINITIONS.** Trans. Amer. Inst. Elect. Engrs II, Vol. 79, 26-32 (1960) = Applic. and Industr., No. 47 (March, 1960).

This report gives the definitions and includes a bibliography of 20 references.

621.314.63

7232 **THE SILICON-CONTROLLED RECTIFIER. I-II.** A.J.Sadler and P.A.Turner.

Control, Vol. 3, 101-3 (Aug.); 108-10 (Sept., 1960).

Describes the operation, manufacturing process and electrical characteristics of controlled rectifiers, with notes on their connection in series and parallel. Circuit diagrams illustrate their use for switching, for d.c. and a.c. controllers, and for inverters. E.F.Hansford

621.314.63

7233 **TURN-OFF CIRCUITS FOR CONTROLLED RECTIFIERS.** D.V.Jones.

Electronics, Vol. 33, No. 2, 52-5 (Aug. 5, 1960).

Triggering and turn-off circuits are described with emphasis on inverter application. A transistor multivibrator is discussed as a pulse source for triggering parallel inverters. A unijunction relaxation oscillator provides a high degree of frequency stability. The gate of a special inverter-type rectifier will regain control in 12 μs or less if the unit is reverse biased with a low-impedance external circuit. A method for measuring turn-off time is presented. An inverter with capacitor turn-off and a parallel inverter for driving reactive loads are investigated. P.Szekely

621.314.63

7234 **SOME ASPECTS FOR TESTING AND ENSURING RELIABLE OPERATION OF GERMANIUM POWER RECTIFIERS.** J.Vilim, M.Kubat and J.Kroczek.

Elektrie, Vol. 14, No. 6, 214-16 (June, 1960). In German.

An account of test procedures for Ge diodes to be built into a mine locomotive. The test included short-term loading at rated current, temperature measurement, checking current distribution in parallel paths and short high-current pulsing. Voltage tests included open-circuit and on-load measurements on the series-connected diodes. P.Szekely

621.314.63/.65

7235 **TRANSIENT DECAY OF CURRENT THROUGH PARALLELED MERCURY-ARC AND SILICON RECTIFIERS.** W.R.Hodgson.

Trans Amer. Inst. Elect. Engrs II, Vol. 79, 70-5 (1960) = Applic. and Industr., No. 48 (May, 1960).

A new silicon rectifier is connected in parallel with a bank of mercury arcs feeding a potline. When the main breaker is pulled out, transformer reactance causes the current through the mercury arcs to die away, but the silicon units, connected directly across the busbars, take a direct-current surge which may reach six times full load. To determine its value the circuit constants are lumped, an equivalent d.c. circuit is drawn, and the formulae for transient decay are developed. These are fed into a differential analyser and a typical set of decay curves are given. Further curves show how variation of the circuit parameters effects the value of the surge current. 4 references. E.F.Hansford

621.314.634

7236 **ON SOME DYNAMIC EFFECTS IN SELENIUM RECTIFIERS WITH EVAPORATED LAYERS OF CADMIUM SELENIDE. II.** J.Kassabov and L.Draseva.

C.R. Acad. Bulg. Sci., Vol. 12, No. 1, 9-12 (Jan.-Feb., 1959). In German.

For Pt I, see C.R. Acad. Bulg. Sci., Vol. 10, No. 3, 181 (1957).

Loss of effective rectification is examined for rectifiers with and without evaporated surface layers of cadmium selenide. The latter reduces the loss as the applied voltage is raised, the effect being observed over a wide range of operating temperatures.

G.F.J.Garlick

621.314.634 : 539.2 : 537.311

7237 THE ELECTRICAL CHARACTERISTICS OF SOME TYPES OF SELENIUM RECTIFIERS.

I.Kh.Geller and P.V.Sharavskii.

Fiz. tverdogo Tela, Vol. 2, No. 7, 1441-9 (July, 1960). In Russian.

Voltage–current characteristics, capacitances and resistances of 4 types of selenium rectifier (containing, respectively, CdS in 2 forms, TlSe and CdSe) are determined and discussed in relation to the electron–hole transitions in the rectifier material.

R.F.S.Hearmon

621.314.634

7238 A NONDESTRUCTIVE BREAKDOWN PHENOMENON IN SELENIUM RECTIFIERS.

A.C.English and W.H.Tobin.

Trans Amer. Inst. Elect. Engrs I, Vol. 79, 9-14 (1960) = Commun. and Electronics, No. 47 (March, 1960).

Certain overloads produce a thermal runaway, followed by a stabilized breakdown condition which is non-destructive and reversible; the rectifier temperature remains stabilized near the melting point of selenium, under wide variations of electrical and ambient conditions. Tests indicate that small patches of the selenium melt or freeze, thus absorbing or releasing enough latent heat to compensate for the imposed thermal changes. E.F.Hansford

621.314.65

7239 AN IMPROVED METHOD OF ARC EXCITATION IN MERCURY-ARC RECTIFIERS. V.M.Mantrov.

Elektrichestvo, 1960, No. 5, 13-15 (May). In Russian.

Two auxiliary anodes are used and a reactor. Anode 1 strikes in the first positive half-cycle, forcing current through the reactor. The reactor e.m.f., induced when the A.1. current is stopped, excites anode 2 and so on, the action being cumulative. The method is intended to avoid losses due to a continuously ignited excitation arc. Theory and some practical hints are given.

Z.A.A.Krajewski

621.314.65

7240 ON THE RADIAL CONTRACTION OF A LOW PRESSURE ARC IN MERCURY VAPOUR. A.Kloss.

Elektrotech. Obzor, Vol. 49, No. 7, 367-72 (1960). In Czech.

Presents experimental results of measurements of ionic currents into negatively charged electrodes in a mercury valve, and describes anomalies of these currents. The path of the ions depends upon the motion of the arc. There is a possibility of arc contraction due to the pinch effect. Assuming the influence of this effect the anomalies and oscillations of ionic currents can be explained.

N.Klein

621.314.65

7241 REPORT OF FIELD TESTS ON ALUMINUM POTLINE RECTIFIER SYSTEMS.

C.A.Langlois, V.N.Stewart and R.P.Stratford.

Trans Amer. Inst. Elect. Engrs II, Vol. 79, 14-21 (1960) = Applic. and Industr., No. 47 (March, 1960).

Tests were made on a large aluminium reduction plant to obtain more data on the characteristics of the electrical system. The three potlines tested were rated at 80 kA, 850 V each, fed by mercury-arc rectifiers from 13.8 kV busbars. Impedance measurements gave test values of the inductance and a.c. resistance of a hot potline under operating conditions. From tests on the system and tie-breakers the transfer and decay times were obtained. Potline start-up measurements were made, and the anode-breakers were tested during arc-back. Test connections, oscillograph records and tabulated results are given. E.F.Hansford

621.314.653

7242 CONTROL DEVICE FOR AN IGNITRON CURRENT CONVERTOR, WITH COMPOSITE BIAS-SHIFT CONTROL USING A VARIABLE DIRECT VOLTAGE.

C.Curie and J.Laborde.

C.R.Acad. Sci. (Paris), Vol. 250, No. 24, 3969-71 (June 13, 1960). In French.

Each ignitron of a three-phase convertor is fired by the discharge of a capacitor through a thyratron. The firing time is controlled by the firing of the thyratrons, achieved by applying to their grids a saw-tooth wave superimposed upon a variable direct voltage. The complete firing and control circuit diagram is given, with component values. The advantages of this method are outlined, and a graph shows that when feeding a d.c. motor there is a linear relationship between speed and bias voltage over the major part of the curve. E.F.Hansford

621.314.653

7243 VOLTAGE TRANSIENTS DUE TO ARC EXTINCTION. H.C.Steiner and R.W.Strecker.

Trans Amer. Inst. Elect. Engrs. I, Vol. 79, 139-44 (1960) = Commun. and Electronics, No. 48 (May, 1960).

Sudden cessation or change in magnitude of the current that is flowing through a gas conduction tube may give rise to a high voltage transient. Physical factors involved in cathode-spot extinction and gas-starvation phenomena are reviewed, two of the conditions of operation that have been recognized as contributing or being capable of creating the rapid rate of current change that is necessary to generate the voltage transient. The paper also indicates the conditions under which such phenomena are likely to occur, discusses the probable voltage generated and the factors within the tube which tend to limit this voltage and finally outlines some of the protective circuits that have been employed to prevent damage to transformers or associated equipment. R.Hawley

621.314.66

7244 A STUDY OF FIRING OF A SECTIONALIZED HIGH VOLTAGE VALVE.

N.M.Maslennikov, A.A.Sakovich and V.D.Andreev.

Elektrichestvo, 1960, No. 6, 25-9 (June). In Russian.

This is an account of experiments carried out with high-voltage mercury-arc converter valves, types VR-9 and VR-4, the VR-9 being rated at 130 kV, 300A. Control characteristics and oscillograms of electrode potentials on firing are illustrated. Firing times are quoted and conditions for reliable operation are discussed. Z.A.A.Krajewski

POWER TRANSMISSION OVERHEAD LINES . CABLES

621.315.051.024

7245 ECONOMY OF GAS CONVEYANCE AND ELECTRIC POWER TRANSMISSION COMPARED.

M.M.Albegov and N.N.Krachkovskii.

Elekt. Stantsii, 1960, No. 1, 30-5 (Jan.). In Russian.

The details given show that power transmission is more advantageous than natural gas transport for distances of 1000 km upwards, and up to 250 km gas is preferable. In the range 250-1000 km gas is the more effective for a heavy loading and power transmission for a relatively low demand. The economic advantages of long-distance d.c. transmission are so great that for 1500 km upwards, a supply divided between gas transport and power transmission may prove more advantageous than one effected entirely through a gas pipeline.

Central Electricity Generating Board Digest

621.315.1 : 621.317.39

7246 A POWER-LINE TRANSIENT RECORDER. C.H.Hoshall.

Trans Amer. Inst. Elect. Engrs I, Vol. 79, 170-3 (1960) = Commun. and Electronics, No. 48 (May, 1960).

This equipment, while operating continuously, provides a permanent record on photographic paper only on the occasion of a fault. Input signals frequency-modulate a voltage-controlled oscillator, the output of which is applied to an 8-track magnetic recording drum. The recorded signals are stored on the drum for just under 1 sec, towards the end of which period they are picked up by a playback head, demodulated and applied to a recording oscilloscope which is, however, not normally operating. Incoming signals indicating a fault energize relays which in turn switch on the oscilloscope in time to record the fault delayed by the store. Wideband frequency modulation using a 3 kc/s carrier frequency is employed. The equipment is transistorized and is transportable.

H.G.M.Spratt

621.315.1

7247 SELECTED OPERATING VOLTAGES, NETWORK CONNECTIONS AND APPARATUS FOR THE MORE ECONOMIC SOLUTION OF TRANSMISSION AND DISTRIBUTION QUESTIONS. G.Hameister.
World Power Conference, Section Meeting (Montreal, 1958). Section D, Paper 91 D/4, 17 pp.

In 1957, the electricity consumption in Western Germany was more than 80×10^9 kWh, of which 70% was distributed by the public utilities and 30% by industry (including 1.5% by the Federal Railways). The distribution installations for high, medium and low voltage account for 58% of the total investment for public supply. Two possible ways of reducing distribution costs are by increasing the sales of energy and by raising the operating voltage. Reasons for and against conversion to a higher voltage in specific cases are discussed on an economic basis and illustrated by diagrams. It may also be economic to overload transformers even at the cost of shortening their life. There would be an advantage in introducing standardized equipment, but this can generally be done only in new installations. The possibilities of reducing transmission and distribution costs on any existing network have to be considered separately and a thorough investigation has to be made of its lay-out and operation. E.W.Golding

621.315.1 : 620.9

7248 RELATIVE COSTS OF TRANSMITTING ENERGY AS ELECTRICITY OR AS NATURAL GAS.
W.N.Foster and K.W.Finch.
World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper III/1, 8 pp.

It is shown that when natural gas is available as a fuel, then for a 40-mile transfer of energy to be used as electricity above certain loads, it is cheaper to site the power station near to the load centre than near the source of gas.

621.315.1 : 620.9

7249 ECONOMICS OF LONG-DISTANCE FUEL TRANSPORTATION AND ELECTRIC TRANSMISSION.
G.Falomo.
World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper III/2, 20 pp.

The technical and economic aspects of long-distance transport of energy to meet the lack or shortage of sources of energy in certain countries of continental Europe are examined. It has been assumed that capacities from 100 to 1.000 MW are to be transported over distances from 100 to 1.000 km, for 8.000 and 4.000 hrs of utilization per year. For each type of fuel (crude oil, natural gas and coal) different means of transportation have been envisaged for the comparison with transmission of electric energy. The calculated cost curves show that fuel transportation is more economical for crude oil by pipeline, for natural gas by pipeline over 400 km and for coal by waterway; in the other cases, transportation in the form of electric energy is usually more economical.

621.315.1 : 620.9

7250 ECONOMIC LIMITS FOR THE TRANSPORT OF FUELS FOR THERMAL POWER STATIONS.
M.Velasco Moreno.
World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper III/3, 13 pp. In Spanish.

Briefly surveys the conditions of coal and fuel-oil transport in Spain by road, rail, sea and other methods. Tariffs, prices and other current economic data are used to compare the total cost of supplying certain thermal stations with coal by rail and by road, and those of transmitting the equivalent electrical energy by overhead wire; hence limit-distances for economic fuel transport are deduced. Mention is made of the influence of the calorific power of the coal and of the effect on costs that arises from the need to build branch railway lines of some importance.

621.315.1 : 620.9

7251 LOCATION OF THE FUEL AND POWER INDUSTRY AND COMPARATIVE ECONOMIC EFFECTIVENESS OF DIFFERENT TYPES OF FUEL AND POWER TRANSPORT.
A.Probst and V.Saveliev.
World Pwr Conf., Sectional Meeting (Madrid, 1960), Paper III/4, 16 pp.

Consideration is given to the effect of concentration of production at the modern level of technical development upon the economy of fuel output and energy generation, and how progress in transport facilities provides the possibility of the more complete realization of economic advantages obtained as a result of concentration. The comparative economic effectiveness of various types of fuel transport and electric transmission is also considered with regard to its influence on territorial distribution of industry in different conditions and particularly on special centralization of its distribution. Particular attention is paid to the economic advantages of the pipe-line transportation of oil and natural gas as well as to the energy transmission over d.c. high-voltage lines.

621.315.1

7252 THE INFLUENCE OF ELECTRICITY CONSUMPTION ON THE ELECTRIC TRANSMISSION AND DISTRIBUTION COSTS. F.Petri, S.Lalander and C.E.Lind.
World Power Conference, Sectional Meeting (Montreal, 1958), Section D, Paper 57 D/7, 29 pp.

Two trends in electricity supply have been noticeable almost everywhere over the past years: the increase in consumption and the fall in the real price. It has not always been fully appreciated that the fall in price is mainly due to the reduction of transmission and distribution costs because for the most part production costs have not fallen. In thermal-power countries, the rising costs of fuel tend to offset increased efficiency and in hydro-power countries the new sources that might be exploited are generally less economically attractive. Consequently, the small consumers have benefited more than the large industrial consumers as the latter bear more of the production costs. The situation in Sweden, where the supply is mainly hydro-electric, is explained and illustrated with diagrams. With an increasing load, the transmission and distribution costs will become relatively smaller, especially in the rural areas, and it will be possible to reduce still further the price to the consumer. This reduction will, in turn, stimulate greater demand. E.W.Golding

621.315.1

7253 VIBRATIONS IN CONDUCTORS OF ELECTRIC LINES. C.C.G. del Valle.
An. Mecan. Elect., Vol. 37, No. 1, 17-25 (Jan.-Feb., 1960). In Spanish.

The causes of vibrations are investigated and formulae are given for calculating the frequencies of the vibrations. The consequences of the vibrations are briefly described. Apparatus for measuring the vibrations and antivibrational appliances are described and illustrated. R.Neumann

621.315.1

7254 REASONS FOR THE INTRODUCTION OF THE 400 kV VOLTAGE STEP FOR NATIONAL POWER SUPPLY.
G.Boll.
Bull. Sci. Assoc. Ingen. Montefiore (A.I.M.), Vol. 73, No. 5, 305-18 (May, 1960). In French.

To control short-circuit powers a national system will generally consist of a connected very-high-voltage system and sectioned lower-voltage systems, exchanges of power between such sections being effected through the system of the next highest voltage. Interconnection with neighbouring countries would be made at the highest voltage. In a highly industrialized country in which the demand doubles every ten years the voltage steps should not be too small; a factor of 3 may not be to large. The principles outlined are then considered with reference to Belgium, the conclusion being that a 380 kV system would be a good long-term solution. A.P.Wilmshurst

621.315.1

7255 CONSIDERATIONS AFFECTING THE ESTABLISHMENT AND STRUCTURE OF A 400 kV SYSTEM FOR REGIONAL INTERCONNECTION. E.Méan.
Bull. Sci. Assoc. Ingen. Montefiore (A.I.M.), Vol. 73, No. 5, 287-304 (May, 1960). In French.

In areas of high load density with local generation different factors may influence the setting up of a 400 kV system; (a) increase of load; (b) larger power stations necessitating heavier load transfers; (c) interconnection with other areas or countries; (d) immediate erection of complete high-capacity power stations; (e) limitation of short-circuit power in the lower-voltage system; and (f) wayleaves. The studies which must be undertaken before embarking on a 400 kV project are outlined. These include short-circuit limits, transformer ratings and system configuration. A.P.Wilmshurst

621.315.1

7256 THE FUNCTION AND STRUCTURE OF THE FRENCH 400 kV NETWORK. F.Cahen.

Bull. Sci. Assoc. Ingen. Montefiore (A.I.M.), Vol. 73, No. 5, 319-37 (May, 1960). In French.

The main function of the 400 kV system is power exchange between the southern part of the country with its sources of hydro-electric power and the northern industrial areas with local thermal generating plant. Regional interconnection is effected mainly by the 225 kV system but there is now a feed from the 400 kV system to the Paris area. This enables the 225 kV system to be sectioned so as to limit the short-circuit power. Increasing demand will necessitate further connections between the two systems, and substation design and the merits of double-wound and auto-transformers, 1-phase and 3-phase are discussed. A.P.Wilmshurst

621.315.1

7257 THE 400 kV NETWORK, FUTURE STAGE OF REGIONAL INTERCONNECTION (IN ITALY).

A.Dalla Verde and M.Maggi.

Bull. Sci. Assoc. Ingen. Montefiore (A.I.M.), Vol. 73, No. 6, 343-54 (June, 1960). In French.

The existing 220 kV system meets all present needs and there is no justification for a higher voltage in the immediate future. As, however, the development of a 400 kV system would presumably take the same course as the 220 kV system, the functions of the latter are described. Its main purpose is to feed the Po valley and other industrial areas from hydro-electric centres in the Alps and Appenines; it also permits seasonal exchanges of power between different parts of the country. Some lines are already being built with a view to later conversion to 400 kV. A.P.Wilmshurst

621.315.1

7258 THE 400 kV NETWORK, FUTURE STAGE OF REGIONAL INTERCONNECTION [IN SWEDEN] .

G.Jancke.

Bull. Sci. Assoc. Ingen. Montefiore (A.I.M.), Vol. 73, No. 6, 357-71 (June, 1960).

The 400 kV system was constructed to transmit energy from hydro-electric stations in the north to the industrial areas and large cities in the south. Problems include measures to increase the transfer ability. In future the system will be used increasingly to interconnect areas with their own generating plant and finally in districts with high load concentration fed from local generating plant. Short-circuit power will then become a major factor and the problems associated with circuit-breakers, transformers and conductors are reviewed. The use of current-limiting reactors is not favoured. Economic planning involves a compromise between low costs and high operational profit-earning capacity. To calculate the latter it is usual in Sweden to bring in the cost of an interruption. Present prices for the elements of the 400 kV and 150 kV systems are given and experience of voltage control is described.

A.P.Wilmshurst

621.315.1

7259 THE 400 kV NETWORK, FUTURE STAGE OF REGIONAL INTERCONNECTION [IN GREAT BRITAIN].

H.B.Dreyfus.

Bull. Sci. Assoc. Ingen. Montefiore (A.I.M.), Vol. 73, No. 6, 373-7 (June, 1960).

Gives a short statement of the present position. The 275 kV lines are designed for conversion to 380 kV and one line is being so converted for experimental purposes. The question of wayleaves may have an important bearing on the decision to go to 380 kV rather than build more 275 kV lines. A.P.Wilmshurst

621.315.1 : 621.314.6

7260 D.C. POWER TRANSMISSION. III. RECTIFIERS AND INVERTERS. R.Feinberg.

Elect. J., Vol. 164, No. 5, 294-99 (Jan. 29, 1960).

For Pt II see Abstr. 3319 of 1960. The behaviour of mercury-arc convertors using the three-phase bridge or double-way arrangement giving six-pulse rectification or inversion is discussed. The three-phase double-way inverter, d.c. power transmission with cascaded mercury-arc convertors, grid control of mercury-arc valves, and present research work on h.v. transmission problems is considered. Central Electricity Generating Board Digest

621.315.1

7261 D.C. POWER TRANSMISSION. IV. TRANSMISSION CIRCUITS. A.L.Williams.

Elect. J., Vol. 154, No. 10, 619-26 (March 4, 1960).

For Pt III, see preceding abstract. Air and solid insulation of overhead lines and two-wire and earth-return circuits are considered. The basis of design of a.c. cables is discussed and compared with d.c. cables. D.C. stress distribution and cable dielectrics are dealt with. Central Electricity Generating Board Digest

621.315.1

7262 D.C. POWER TRANSMISSION. V. OPERATION AND CONTROL. G.Engstrom.

Elect. J., Vol. 164, No. 15, 1048-54 (April 8, 1960).

For Pt IV, see preceding abstract. The general design of mercury-arc valves is described and the control of the inverters, regulation during normal operation, regulation of power, frequency etc., regulation during abnormal conditions and switching and protective gear are considered. A description is given of the start and control of e.h.v. d.c. transmission system, examples being given of the Gotland scheme.

Central Electricity Generating Board Digest

621.315.1

7263 D.C. POWER TRANSMISSION. VI. PLANNING AND ECONOMICS. J.L.Egginton.

Elect. J., Vol. 164, No. 19, 1271-80 (May 6, 1960).

For Pt V, see preceding abstract. The choice of a.c. or d.c. systems is discussed and the relative costs are considered. A description is given of the cross-channel cable and is dealt with under three broad headings. First, the alternatives which have been considered for transmission at a.c. and d.c. and, why d.c. has been chosen. Secondly, the special problems involved in the construction of the project, particularly in regard to laying the cable; and thirdly, the economic reasons justifying the decisions to connect this country to the Continent. Future prospects of d.c. transmission are dealt with.

Central Electricity Generating Board Digest

621.315.1

7264 THE ORIGIN, NATURE AND ORDER OF MAGNITUDE OF HIGH FREQUENCY OSCILLATIONS PRODUCED BY THE OPERATION OF DISCONNECTING SWITCHES ON HIGH VOLTAGE TRANSMISSION LINES. R.Jaudet.

Bull. Soc. Franc. Elect. (Ser. 8), Vol. 1, No. 6, 381-8 (June, 1960). In French.

The operation of load disconnecting switches connected to short lines and bus bars produces high frequency transient oscillations, the fundamental frequency of which often lies in the band used by carrier equipment. These high voltage oscillations may cause damage to the high frequency equipment. Protection can be provided by sparks gaps and filter circuits. A.S.Hay

621.315.1 : 621.387

7265 THE SURGE CORONA DISCHARGE. R.Davis and R.W.E.Cook.

Proc. Instn Elect. Engrs, Monogr. 415 S, publ. Nov., 1960, 10 pp. To be republished in Part C.

Exploratory experiments are described followed by an account of a more systematic study of the corona discharge with concentric-cylinder electrodes. From experimental records which relate the charge flow in an external circuit to the applied voltage, the corona current and energy loss were derived. An attempt is made to interpret the observations in terms of modern views on the mechanism of electrical breakdown in gases. The attenuation by corona of surges on transmission lines is examined in an Appendix.

621.315.1

7266 A NEW METHOD OF MAKING TRANSMISSION-LOSS FORMULAS BY MEANS OF EIGENVALUES AND MODAL MATRICES. E.E.George.

Trans. Amer. Inst. Elect. Engrs III, Vol. 79, 287-98 (1960) = Pwr. Apparatus Syst., No. 48 (June, 1960).

A proposed new method of making total-transmission-loss formulae on a digital computer is described. The method is said to be more direct, accurate and economical than any previous method. Although based on a relatively advanced mathematical technique which has only recently been developed for digital computers, the utility engineer can use the method without understanding the theoretical background. An outline of the technique is followed by descriptions of the application of eigen methods to loss

formulae and the general method of using eigenvalues and modal matrices with particular reference to large power networks. The author's conclusions are called into question in the discussion. A full list of references is given. G.V.Hargreaves

621.315.17

7267 DESIGN OF CHUTE-DES-PASSES 345 kV TRANSMISSION LINE. H.B.White.
Elect. J., Vol. 164, No. 15, 1035-8 (April 8, 1960).

A short description of two single-circuit lines 92 miles long connecting two hydro-electric generating systems of the Aluminum Co. of Canada; the total transfer ability is 750 MW. Towers are of conventional rigid lattice type carrying twin s.c.a. conductors with provision for a third wire. A prototype aluminium guyed tower has proved satisfactory. A.P.Wilmshurst

621.315.17

7268 THE CONSTRUCTION OF THE 380/110 kV RAUXEL–PÖPPINGHAUSEN LINE. H.Mors and G.Vorschulte.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 14, 338-9 (July 11, 1960). In German.

This line carries two 380 kV circuits in triangular formation and below them two 110 kV circuits spaced horizontally. It is 3.3 km long and runs through heavily built-up areas; the special foundations are described in detail. P.Linton

621.315.17

7269 A GENERAL TRANSMISSION CHART FOR USE IN ELECTRIC POWER SYSTEMS. F.J.Evans.
Instn Engrs, Austral., elect. mech. Engng Trans, Vol. EM1, No. 2, 69-79 (Nov., 1959).

A general transmission chart is described from which the voltage drop, transmission angle and losses, active and reactive, can be obtained for any transmission circuit under any specified loading conditions. The chart deals with overhead lines, underground cables, transformers, series reactors and series capacitors or any combination of these, or in fact with any transmission circuit expressed in equivalent π form.

621.315.17

7270 SAG–TENSION COMPUTATIONS AND FIELD MEASUREMENTS OF BONNEVILLE POWER ADMINISTRATION. P.F.Winkelman.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1532-48 (1960) = Pwr Apparatus Syst., No. 46 (Feb., 1960).

The B.P.A. has over 8000 miles of lines, a large proportion being in rugged mountain terrain. Conditions are aggravated by a wide range of temperatures, ice and snow loading and steeply inclined spans. The derivation and use of tension–strain curves of the various sizes of conductor are described. These curves are based on rigorous calculation checked by repeated tests; in the actual application corrections for local conditions are made from tables and nomograms. A.P.Wilmshurst

621.315.17

7271 ECONOMICS OF SINGLE AND BUNDLE CONDUCTORS FOR EXTRA-HIGH-VOLTAGE TRANSMISSION. P.A.Abetti, C.B.Lindh and H.O.Simmons, Jr.
Trans Amer. Inst. Elect. Engrs III, Vol. 79, 138-53 (1960) = Pwr Apparatus Syst., No. 48 (June, 1960).

Whereas bundle conductors are used exclusively for voltages of 330 kV and above and on many lower voltage lines there is no agreement as to the optimum number of conductors in a bundle. A method is developed whereby the optimum configuration and conductor size may be determined taking account of all parameters of economic significance. The method is applicable to a wide variety of systems and ranges of transmission distances, voltages and circuit loadings. Fifty-eight cases were studied with the aid of a digital computer. Radio interference and sleet-prevention may necessitate deviations from the most economical design. A.P.Wilmshurst

621.315.17

7272 APPLYING A JET OF WATER FROM FIRE FIGHTING NOZZLES TO H.V. LINES. H.Baatz.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 14, 333-7 (July 11, 1960). In German.

A summary of the existing contradictory recommendations is followed by the results of tests giving currents for various voltages, distances and types of jet. As convincing proof of the recommended safe distances the author personally carried out some spraying tests at distances down to 3 m at 110 kV. P.Linton

621.315.177

7273 LIVE LINE WORK. O.D.Zetterholm.
Elect. Rev., Vol. 167, No. 8, 291-5 (Aug. 19, 1960).

Safety regulations, tools and procedures for live line maintenance, which are being applied in Sweden, are described. Swedish general safety regulations allow only a very limited amount of hot-line maintenance work: viz. on sections where the voltage is up to 75 V, work on trolley lines with a maximum of 1500 V, short-term work on lines up to 250 V, and work on switchgear under 600 V. At voltages above these values special permission is required. Working methods for insulator testing, changing insulators and switchgear work are discussed. Central Electricity Generating Board Digest

621.315.177

7274 NEW DEVICES FOR DISCONNECTING LIVE CONDUCTORS FROM SUSPENSION STRINGS. T.P.Musatov.
Elekt. Stantsii, 1960, No. 1, 53-5 (Jan.). In Russian.

Describes new devices for disconnecting live conductors from suspension strings. This operation was rendered necessary by the strengthening of the insulation of a 110 kV line, 80 km long. One of these experimental disconnection devices, which is used in conjunction with a telescopic tower for repair and maintenance work on the power lines, has been giving satisfactory service for over a year. Central Electricity Generating Board Digest

621.315.2

7275 DETERMINATION OF LIMITING TEMPERATURES AND LOADS OF ELECTRIC LINES. F.Fabinger.
Elektrotech. Obzor, Vol. 49, No. 6, 294-7 (1960). In Czech.

Based on Montsinger's relation for the ageing of insulation, temperature and load limits as functions of insulation life-time were calculated for the following cases: (1) the temperature of an insulated line increases linearly, (2) the load of the line varies cyclically; (3) a group of parallel lines are loaded, in such a way that, cyclically, one of them is not loaded; and (4) short-time overload is applied to the line. Calculated examples are given. N.Klein

621.315.2

7276 AMERICAN LEAD ALLOY CABLE SHEATHS. IV. MANUFACTURING DETAILS. V. GENERAL SUMMARY. S.A.Hiscock.
Elect. J., Vol. 164, No. 20, 1339-40, 1340 (May 13, 1960).

For other parts see Abstr. 4011, 5398 of 1960. Part IV is a short note on extrusion procedure and post-extrusion treatment of sheaths. Particulars of mechanical behaviour of various alloys are tabulated. In Part V attention is drawn to the fact that some of the alloys considered have combinations of attractive properties not exhibited by alloys previously used for cable sheathing. A.P.Wilmshurst

621.315.2

7277 SOME RESULTS OF DIRECT TESTS ON THE 225 kV H.V. CABLE NETWORK OBTAINED AT THE RESEARCH AND TESTING STATION OF FONTENAY. R.Tellier.
Bull. Soc. Franc. Elect., Vol. 1, No. 8, 511-34 (Aug., 1960). In French.

Presents the principal results of tests made and outlines the techniques employed with particulars of the cables and voltages used. In some cases the voltage was applied for periods up to 24 hours. The cables included oil-pressure and steel-pipe nitrogen-pressure examples and their performances are compared. Attention was also directed to thermal phenomena arising. A.P.Paton

621.315.2 : 621.316.11

7278 THE RECENT DEVELOPMENT OF TECHNIQUE FOR H.V. AND V.H.V. CABLE DISTRIBUTION SYSTEMS ON THE FRENCH NETWORKS. G.Froidure.
Bull. Soc. Franc. Elect., Vol. 1, No. 8, 535-45 (Aug., 1960). In French.

Gives a brief history of the revolution in the Paris region of such systems in 3 stages, viz., 1922-32, 1932-45 and 1945-to date. The various types of cable for voltages up to 225 kV are described and illustrated with sections on drawing cables into steel tubes, jointing, and cathodic protection. There are notes on systems in the

Marseilles, Bourges, and Havre areas and on the cross-channel project. A.P.Paton

621.315.2 : 621.317.39

7279 A THIRD 50 kV CROSSING OF THE SCHELDT ESTUARY. G.Galkhorst and C.J.Kalis.
Electrotechniek, Vol. 38, No. 15, 379–88 (July 21); No. 16, 410–18 (Aug. 4, 1960). In Dutch.

The increased load in Dutch (Zeeuws) Flanders on the south bank of the Scheldt required the laying of an additional 3-ph. cable across the 6.5 km-wide estuary. An oil-pressure cable with 120 mm^2 copper cross section was chosen. The cable was laid beneath the river bed to avoid damage from dragging anchors. The laying was carried out with the aid of a suction dredger, the operation being described in detail. The position of the cable was checked during and after laying using search coil and oscillator, insulated copper wires being already included in the steel armouring of the cable to facilitate application of a magnetic field around the cable for measurement purposes. The design of the search coil, the apparatus for measuring the induced voltage and the final co-ordination of the measurement results are considered. G.N.J.Beck

621.315.211.2

7280 POLYVINYL CHLORIDE FOR HIGH VOLTAGE POWER CABLES. W.Ehlers and J.L.Stewart.
Instn Engrs, Austral., elect. mech. Engng Trans, Vol. EM1, No. 2, 81–8 (Nov., 1959).

An attempt is made to specify the methods of testing and selecting p.v.c. compounds with regard to their application for voltages higher than 1 kV. It is shown that it is only necessary to determine the position of the minimum of the loss factor–temperature characteristic for each compound under consideration, and to select that compound which has the lowest minimum at or just above the maximum service temperature of the cable. For plasticized compounds it is suggested to use the correlation between frequency, temperature and degree of plasticization dependences to produce for the entire polymer (or copolymer)–plasticizer system one map only, showing the loci and magnitudes for the loss factor minima, simultaneously for all variations in temperature, frequency and plasticization degree. The results of measurements on sample cables with plasticized and also with entirely unplasticized p.v.c. dielectrics are given and discussed. It will be shown that, from the dielectric loss point of view, plasticized p.v.c. may safely be used for cables up to about 16 kV, and unplasticized p.v.c. for cables up to about 30 kV, if the suggested methods of testing and selecting are applied. A method of manufacturing entirely unplasticized p.v.c. insulated cables is suggested.

621.315.211.3

7281 WATER COOLING OF POWER CABLES. D.A.Thoms and W.Holdup.
Elect. Times, Vol. 137, 957–9 (June 16, 1960).

Describes two experimental installations of 132 kV oil-filled cables utilizing water cooling. In one case pipes are laid close to the cables whilst in the second case a number of ducts are provided formed of segmental shaped p.v.c. tubes laid up round the cable in the form of a sheath. This system is illustrated and described. A curve was obtained showing the water-flow rates and permissible current loading. Under favourable conditions it is apparent that it would be possible to achieve a 100% increase in the load-carrying capacity of the cables. R.J.Jordan

621.315.211.3 : 621.315.615.22

7282 THE INFLUENCE OF AGEING ON THE CHARACTERISTICS OF OIL-FILLED CABLE DIELECTRIC. P.Gazzana-Priaroggia, G.L.Palandri and U.A.Pelagatti.
Proc. Instn Elect. Engrs, Paper 3348 S, publ. Nov., 1960, 13 pp. To be republished in Vol. 108A (1961).

An investigation has been made of the electrical and mechanical characteristics of the insulation of samples of cables in the range of 60–230 kV after many years of operation in order to evaluate the influence of ageing on the dielectric of oil-filled cables. To determine the effect of thermal ageing alone and in combination with electrical stress, a long series of laboratory tests has been carried out on components of cable insulation, on cable models and on actual cables. A comparison has been made between the laboratory investigations and the state of the insulation of cables after many years of operation. The following conclusions have been drawn: (a) paper is the component most affected by temperature; (b) the electric strength is not influenced, within the limits of the tests, by the combined effects of temperature and electric stress; (c) cables examined after more than 20 years of operation are still in perfect condition and will go on operating satisfactorily for many more years if present loading conditions are maintained. It is suggested that the mechanical deterioration of paper should be taken as a criterion of the state of used cables and to fix, for both new and used cables, the temperature limits for normal and emergency loading in relation to the desired life of the cable.

621.315.213

7283 THE DIMENSIONING OF CABLES AND CONDUCTORS FOR TELEPHONE INSTALLATIONS. P.Høgholt Madsen.
Teleteknik, Vol. 11, No. 1-2, 12-27 (June, 1960). In Danish.

The most economic values of the wire-to-wire capacitance for polyethylene-insulated cables are determined and compared with those for paper–air insulated cables. Formulae are also worked out for the optimum dimensions of telephone cables of various cross-sections — twin-circular, elliptical and "flat". G.N.J.Beck

621.315.221

7284 DAMAGE BY RODENTS TO CABLES WITH SYNTHETIC INSULATION. K.Becker.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 13, 311-14 (June 27, 1960). In German.

Based on a series of experiments, it is concluded that rats and mice do not use the covering of the cables as food or as material for their nests. Their only object in gnawing is to remove obstacles from their runs. It is recommended that damaged places should be protected by hard material, such as steel tape. The damage to p.v.c. is no different from that to other insulating coverings. A bibliography is added. R.G.Jakeman

621.315.221.5 : 620.9

7285 THE CORROSION OF LEAD-COVERED CABLES (11TH REPORT). A.Brunold.
Tech. Mitt. P.T.T., Vol. 38, No. 4, 121-43 (1960). In French and German.

For previous part, see Abstr. 944 of 1960. This is the eleventh of a series of reports on a long-term investigation carried out by the Swiss P.T.T. It describes the equipment and use of a mobile laboratory for carrying out chemical analysis in the field. V.G.Welsby

621.315.23 : 681.142

7286 MATHEMATICAL SOLUTION TO THE PROBLEM OF THE CONTROL OF THE THERMAL ENVIRONMENT OF BURIED CABLES. J.V.Schmill.
Trans Amer. Inst. Elect. Engrs III, Vol. 79, 175-82 (1960) = Pwr Apparatus Syst., No. 48 (June, 1960).

An early approach to the problem of cable trench back-fill to provide required soil resistivity values was based on the concept of a rectangular trench filled with suitable material. Here, the distortion of the lines of heat flow pattern resulting from the diffraction produced at the boundaries of media of differing conductivities is considered. Formulae are developed for different boundary conditions and a final rigorous solution is obtained in the form of a convergent series equation. It is admitted that the method is one most suitable for solution by means of a digital computor. The author's analysis reveals that for a homogeneous medium it is more beneficial to place a greater percentage of the special back-fill above and to the sides of the heat source rather than under it. R.J.Jordan

621.315.285

7287 A NEW METHOD FOR LAYING UNDERWATER CABLE. G.Sturm.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 15, 357-9 (July 25, 1960). In German.

A length of plastic pipe closed at both ends is attached to the cable as it is pulled across the water. After it has been located correctly, one end is opened below water and air is allowed to escape from the other end at a controlled rate. The cable sinks from the far end as the pipe fills and can readily be raised again by reinflating the pipe. P.Linton

621.315.287

7288 PROBLEMS ARISING DURING THE LAYING AND RECOVERY OF AN ARMOURED SUBMARINE CABLE. E.Occhini and G.Trogu.

Elettrotecnica, Vol. 47, No. 2, 66-77 (Feb. 10, 1960). In Italian.

A mathematical analysis is given of the factors which control the dynamic behaviour of a submarine cable as it moves through the sea. Particular interest is shown in the question of torsional stability of cables which have externally applied helical armour wires.

V.G.Welsby

INSULATORS
SUPPORTS . CONNECTIONS

(See also Insulating Materials)

621.315.624

7289 THE ELECTRICAL CHARACTERISTICS OF LONG INSULATOR STRINGS FOR LINES AT A VOLTAGE OF 500 kV AND MORE. N.N.Tikhodeev and A.N.Tushnov.
Elektrichestvo, 1960, No. 7, 56-61 (July). In Russian.

Describes the results of tests on long insulator strings carried out in conditions corresponding as far as possible to real conditions.

Associated Electrical Industries (Manchester)

621.315.624 : 621.315.668.1

7290 VOLTAGE DISTRIBUTION BETWEEN A SUSPENSION-INSULATOR CHAIN AND A WOOD POLE.
N.Selseth and H.H.Faanes.
Elektrotek. T., Vol. 73, No. 24, 397-400 (Sept. 25, 1960). In Norwegian.

The voltage distribution between a chain of suspension insulators and a wood pole is compared with the voltage distribution when a steel mast is assumed. It is shown that the capacitance between the insulator cap and the pole is the same for the two types of poles. The influence of the specific resistance of the wood upon the voltage distribution of the chain of suspension insulators is shown. It is concluded that steel and wood poles give identical voltage distributions provided that the specific resistance of the wood is not extremely high.

621.315.624

7291 THE PROBLEM OF THE RELIABILITY OF INSULATOR CHAINS FOR V.H.V. TRANSMISSION LINES. H.Meyer.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 11, 261-3 (May 30, 1960). In German.

A comparison of the performance of cap-type insulators with that of the full-core and long-rod types. It is concluded that the reliability of the full-core type is no less than that of the cap-type.

R.G.Jakeman

621.315.624

7292 APPLICATION OF RELAXATION METHOD IN ELECTRICAL ENGINEERING PROBLEMS. I. DETERMINATION OF POTENTIAL DISTRIBUTION OVER A STRING OF SUSPENSION INSULATORS BY RELAXATION METHOD. R.N.Basu.
J. Assoc. Appl. Physicists, Vol. 5, 24-9 (1958).

It is shown how relaxation methods can be advantageously employed in the determination of the potential distribution over a string of similar suspension insulators used in high voltage transmission systems. The suitability of relaxation patterns, used normally in connection with the solution of differential equations, for solving certain types of linear simultaneous equation is also discussed.

621.315.624

7293 APPLICATION OF RELAXATION METHOD IN ELECTRICAL ENGINEERING PROBLEMS. II. DETERMINATION OF POTENTIAL DISTRIBUTION OVER A STRING OF SUSPENSION INSULATORS BY RELAXATION METHOD. R.N.Basu.
J. Assoc. Appl. Physicists, Vol. 5, 30-5 (1958).

For Pt I, see preceding abstract. This part deals with the relaxational solution of a problem on voltage distribution over a string of similar suspension insulators with a guard ring. It also illustrates a modified method for eliminating residuals in the solution of a set of simultaneous linear equations. The method employed in the solution of the present problem indicates a simple means (for certain types of equation) of obtaining suitable operation blocks which can be utilized in eliminating residuals without bringing about any change in one or more of the remaining residuals.

621.315.663

7294 MAKING USE IF THE PROPERTIES OF FRAMES FOR THE DESIGN OF OUTDOOR LINES. J.Sedlák.
Elektrotech. Obzor, Vol. 49, No. 6, 285-93 (1960). In Czech.

It has been customary to calculate Π-shapes pylons for 3-wire transmission lines as statically determinate structures consisting of two separate T shaped pylons. Π-shaped pylons are treated here as statically intermediate frames and comparative calculations of this kind result in 30% weight saving and corresponding cost decrease in pylon and foundation. A calculated example follows and measurements of deformations confirm the computations.

N.Klein

621.315.668.1 : 621.315.624

VOLTAGE DISTRIBUTION BETWEEN A SUSPENSION-INSULATOR CHAIN AND A WOOD POLE. See Abstr. 7290

621.315.668.2

7295 DYNAMIC [LOADING] CALCULATIONS FOR 400 kV TRANSMISSION LINE ANCHORING TOWERS OPERATING UNDER ABNORMAL CONDITIONS. P.M.Nevskii.
Elekt. Stantsii, 1959, No. 12, 48-53 (Dec.). In Russian.

Dynamic forces and modes of tower vibrations caused by breakage of one phase conductor are calculated for the π-type anchoring tower.

E.M.Dembinski

621.315.668.2

7296 USE OF CABLE GUYS WITH 500 kV METAL ANGLE SUSPENSION TOWERS. E.S.Glebov and B.I.Komissarov.
Elekt. Stantsii, 1960, No. 1, 56-9 (Jan.). In Russian.

With a suitably chosen range of angles of rotation of the run, according to which the angle suspension tower is set asymmetrically relative to the portal of the member under tension, the tower weight can be substantially reduced owing to utilization of the effect of prestressing its members. Initial pull on the guy, determining the strength characteristic of the tower with prestressed members, is easily checked in practice.

Central Electricity Generating Board Digest

DISTRIBUTION . INSTALLATIONS

621.316.1

7297 EXTENSION OF THE HIGH-VOLTAGE SYSTEM OF THE GRONINGEN PROVINCIAL SUPPLY AUTHORITY.
A.Prins.
Electrotechniek, Vol. 38, No. 18, 455-60 (Sept. 1, 1960). In Dutch.

Industrial development of the Groningen province requires planning for greatly increased loads. It is forcast that the Groningen—Kropswolde line will have to carry a 150 MW load in 1972. Special masts to carry three circuits, each for 1000 A, have been designed. Conductors are of Grackle-type steel—Al of 680 mm² section. The layout of the 110 kV switching station at Helpman and that of the 10 kV portion of the Kropswolde substation are described in some detail.

G.N.J.Beck

621.316.1

7298 SOME ASPECTS OF THE HIGH-VOLTAGE SYSTEMS OF THE AMSTERDAM MUNICIPAL SUPPLY AUTHORITY.
M.D.Dalebout.
Electrotechniek, Vol. 38, No. 19, 475-86 (Sept. 15, 1960). In Dutch.

At present distribution in the town is at three voltages; there are approx. 200 km at 50 kV, 1000 km at 10 kV and 700 km at 3 kV, the original voltage used when supply began in 1904. The start of service of the new Hemweg station, which will handle the greater part of the urban supply, has necessitated the construction of new 50/10 kV and 50/3 kV transformer substations, further development of the 50 kV network, and a reduction in number and redirection of supply to the remaining 10/3 kV substations. Maps and circuit diagrams illustrate the change-over operation.

G.N.J.Beck

621.316.1

7299 THE NEW 150 kV INTERCONNECTING SYSTEM OF THE CITY OF MONTEVIDEO. J.Tinzer.
Rev. Electrotec., Vol. 46, No. 5, 161-9 (May, 1960). In Spanish.

A detailed illustrated description of this system consisting of four switching substations interconnected by 150 kV overhead lines

or underground oil-filled cables. The length of the overhead lines is 37 km, that of the cable line 5 km. Three of the substations are fitted with auxiliary busbars allowing the withdrawal of any one of the circuit-breakers for inspection or repair. These auxiliary busbars can later be converted into a second set of principal busbars. The fourth substation was initially fitted with a double busbar system. The substations are of the outdoor type. Ultrarapid air-blast circuit-breakers are used throughout. Differential protection with pilot cables is provided. R.Neumann

621.316.1 : 621.314.2

THE EQUIVALENT CIRCUIT OF TRANSFORMERS IN ELECTRONIC NETWORK CALCULATIONS. See Abstr. 7207

621.316.1 : 621.313.332

ATTAINMENT OF FIELD SYMMETRY IN A THREE-PHASE, ASYNCHRONOUS MACHINE IN A SINGLE-PHASE NETWORK OF VOLTAGE $2V_{\phi\text{-}N}$. See Abstr. 7190

621.316.11

7300 **DISTRIBUTION SECONDARY CONDUCTOR ECONOMICS.** A.S.Anderson and V.A.Thieman.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1839-43 (1960) = Pwr Apparatus Syst., No. 46 (Feb., 1960).

A mathematical treatment is given to determine the most economical size of conductor for a distribution system consisting of a transformer with two-way distributors (secondaries). The economics are based on Kelvin's Law for conductors and formulae are developed to enable minimum conductor sizes to be evaluated, due allowance being made for variable load growth and span variations. Calculations for particular examples are given which include transformer costs. Because of the many variables involved in transformer-secondary design it is stated that there is an excellent field for the application of digital computers. R.J.Jordan

621.316.11 : 621.315.2

THE RECENT DEVELOPMENT OF TECHNIQUE FOR H.V. AND V.H.V. CABLE DISTRIBUTION SYSTEMS ON THE FRENCH NETWORK. See Abstr. 7278

621.316.11 : 681.142

AN A.C. NETWORK ANALYZER WITH CONSTANT-CURRENT GENERATORS AND LOADS. See Abstr. 7029

621.316.13

7301 **NEW MODIFICATION OF THE CLOSED ELECTRICAL NETWORK.** B.L.Aizenberg.
Elekt. Stantsii, 1960, No. 1, 64-7 (Jan.). In Russian.

A scheme is proposed for the conversion of existing "open" urban distribution systems which will minimize the disruption of supply due to cable faults without too great a cost in labour and materials in its realization. The system of transformer points constituting the network is interconnected at both primary and secondary and, to obtain the necessary degree of selectivity in the protection, a fuse unit of new construction is incorporated, having a speed of operation 4.5 to 5 times that of the old type at 4 to 5 times rated current. Although, at present, the new scheme has been applied only to urban networks serving towns of about 10^6 inhabitants, it is assumed that it will be equally applicable to large industrial consumer networks. J.H.B.Gould

621.316.17

7302 **DISTRIBUTION PRACTICE IN ALTERNATING CURRENT SHIPS.** M.J.Bolton.
Elect. Times, Vol. 138, 193-7 (Aug. 11, 1960).

A discussion of the distribution system and protection of feeder circuits, stressing the essential differences from land practice. The use of h.r.c. fuses and circuit-breakers is compared. Alternator protection is discussed and the construction of the equipment is described. R.G.Jakeman

621.316.176

7303 **EVALUTION OF ALTERNATIVE POWER DISTRIBUTION SYSTEMS FOR REFINERY PROCESS UNITS.** W.H.Dickinson.
Trans Amer. Inst. Elect. Engrs III, Vol. 79, 110-23 (1960) = Pwr Apparatus Syst., No. 47 (April, 1960).

Several tables are given for facilitating the calculation of the most economic power distribution system for refineries. The min. revenue requirements of the various alternatives are determined with due regard to the reliability of service. Four different types of distribution systems are studied: (A) radial system; (B) primary-selective system; (C) secondary-selective system; and (D) radial-convertible to secondary-selective system. These four systems are illustrated and their relative merits are discussed. A comparison is made between open wire and cable distribution. R.Neumann

621.316.35

7304 **PRACTICAL SOLUTIONS OF INDUCTIVE HEATING PROBLEMS RESULTING FROM HIGH-CURRENT BUSSES.** N.Swerdlow and M.A.Buchta.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1736-46 (1960) = Pwr Apparatus Syst., No. 46 (Feb., 1960).

Reduction in the heating induced in structural steel, pipes, handrails and other magnetic components in the vicinity of high-current busbars (2 kA and above) can be effected by: (1) short-circuiting bands; (2) amortisseur grids; and (3) shielding plates. The benefits to be derived from each of these devices are shown in a series of curves. Evaluation of laboratory tests has shown that the current in short-circuiting bands and amortisseur grids is generally of the order of 10 to 15% of the line current and calculation of the losses in these devices can be made using the equation $W = 0.0225\ I^2R_{ac}$ where W = total watts loss in device, I = line current, and R_{ac} = a.c. resistance (total) of device. Stresses resulting from restrained expansion due to local heating in reinforced concrete members are discussed. H.A.Miller

SWITCHGEAR

621.316.5

7305 **AN AUTOMATIC TESTING JIG FOR DOMESTIC SWITCHES.**
Elect. J., Vol. 165, No. 10, 590-2 (Sept. 2, 1960).

This equipment, utilizing cold cathode triodes, is capable of performing four separate tests on a switch to prove that: (1) the circuit is made with the switch in the closed position; (2) the switch does not break the circuit too early in its travel; (3) the switch does break circuit; (4) the switch will re-make the circuit, and the dolly will return to the "on" position by itself from the point of break. The switches are tested at normal voltage and at 20% over-current, at a rate of approximately one per sec. Faulty switches are sorted and distributed to four separate bins and automatically counted. Satisfactory switches are fed to a box in front of the machine. Logic circuits incorporating cold-cathode discharge tubes are used for detecting the various types of fault and for initiating the sorting movements, which are then carried out by a pneumatically powered mechanism. Forward and reverse solenoids control the valves of the switch-dolly actuating mechanism. A basic circuit is used in which groups of tubes are made mutually self-extinguishing by the use of a common anode resistor with capacitor, and a series resistor in parallel with the cathode resistor. H.A.Miller

621.316.5

7306 **HIGH ENERGY PLASMAS IN ELECTRICAL ENGINEERING. POSSIBLE APPLICATION IN H.V.D.C. CIRCUIT BREAKING.** J.J.Matthews.
Engineer, Vol. 210, 306-8 (Aug. 19, 1960).

D.C. circuit-breaking can be achieved by the inclusion of a d.c. machine in series with the load which, by means of a suitably programmed excitation, gives rise to sustained a.c. oscillations which in turn operate a conventional a.c. circuit breaker. A suitable machine for this purpose under high voltage conditions would be a d.c. generator in which the armature was replaced by a rotating plasma. Such machines possess potentially very high energy storage capacity with very short energy storage lifetime. Two experimental machines of this type are described together with some of the problems attendent on the confinement of the plasma. This subject is related to the various energy losses which may occur and a useful introductory discussion of the subject is given. G.D.Sims

621.316.5 : 614.825

THE INTRINSICALLY SAFE METHOD OF PROTECTION. See Abstr. 7062

621.316.53

7307 ON THE DIMENSIONING AND DESIGN OF DIRECT CURRENT MAGNETS FOR CONTACTORS. A.Erk.
Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 10, 361-5 (May 9, 1960). In German.

Direct-current actuated contactors possess the advantage that the coil can be matched to the contact mechanism and the system has a certain amount of inherent damping. It is important for the life expectancy of a contactor that the surplus force exerted by the coil is kept to a minimum. Force measurements have been made upon a d.c.-excited cylindrical test magnet with interchangeable cores to determine the most suitable pole shape. Test results show that conical pole surfaces produce good characteristics and keep dimensions small. A.S.Hay

621.316.54 : 621.318.562.7

7308 TIME-SEQUENCE SWITCH SAFEGUARDS ELECTRO-MECHANICAL LOCKS. D.H.Thompson and D.Simpson.
Electronics, Vol. 33, No. 28, 64 (July 8, 1960).

A transistorized time-sequence switch is described which operates at 10 ms intervals and handles highly inductive loads at currents up to 5 A. The unit is shock and vibration resistant. The circuit diagram is drawn. A.C.Brown

621.316.57

7309 SYNTHETIC CIRCUIT FOR TESTING CIRCUIT-BREAKERS WITH LONG-BURNING ARCS.
N.M.Chernyshev and Z.A.Abramova.
Elektrichestvo, 1960, No. 7, 41-6 (July). In Russian.

A description is given of a new synthetic circuit developed from investigations by the authors into methods of testing circuit-breakers and which is particularly effective for circuit-breakers with long-burning arcs and with a relatively high voltage-drop in the arc. The circuit tests the circuit-breakers by means of a pulsating current and an experimental check on the apparatus has shown satisfactory results. Associated Electrical Industries (Manchester)

621.316.57

7310 SYNTHETIC TEST PROCEDURES FOR HIGH VOLTAGE POWER CIRCUIT-BREAKERS. A.Hochrainer.
Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 10, 349-55 (May 9, 1960). In German.

As it is not possible to obtain sufficient short-circuit capacity for test requirements in the network for which a circuit-breaker is intended and as indirect methods of testing have been proved to be inadequate, synthetic test procedures have been developed. These procedures make use of the fact that stresses acting on the circuit-breaker due to current and voltage do not occur at the same time. However, if a synthetic test is to be accepted, there must be no interval between the application of current and voltage stresses. The Weil–Dobke circuit achieves this end by closing the voltage circuit before current zero occurs. The voltage circuit is made oscillatory to prevent the voltage from falling to zero because of the short-circuiting effect of the current. The Weil-Dobke circuit can be supplemented to test circuit-breakers with an arc duration greater than one half cycle, so that not only air-blast but also oil circuit-breakers may be tested. A.S.Hay

621.316.57

7311 A NEW QUICK-BREAK SWITCH FOR THE PROTECTION OF D.C. TRACTION MOTORS IN MOTOR-COACHES.
H.Fehling.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 16, 387-92 (Aug. 8, 1960). In German.

Describes the principle of operation, constructional details, performance data and test programme of a new circuit-breaker rated at 600-1000 A, 1.5 kV, the operation of which depends on the rate of rise of current. Many diagrams, photographs and oscillograms are included. J.T.Hayden

621.316.57.064.25

7312 INVESTIGATION OF THE ARC IN AN AIR-BLAST CIRCUIT-BREAKER. N.Z.Aronzon and V.V.Mezhueva.
Zh. tekh. Fiz., Vol. 30, No. 5, 555-60 (May, 1960). In Russian.

Other conditions being equal, increase of the circuit-breaking gap results in a decrease of the longitudinal gradient in the arc and an increase of the arc diameter. It appears that a certain temperature increase takes place in the arc column along the air-blast direction. F.Lachman

REGULATION

621.316.71

7313 OPTIMAL LAWS FOR ELECTRIC-DRIVE CONTROL. Yu.P.Petrov.
Avtomat. i Telemekh., Vol. 20, No. 7, 884-91 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 7, 860-7 (July, 1959; publ. March, 1960).

Considers optimal laws for electric-drive control which provide maximum productivity for given limitations on heating. Optimal control laws are derived for various forms of functional dependences of the motor's magnetic flux on the armature current and of the impedance moment on the rotational speed.

621.316.71

7314 THE APPLICATION OF STATIC SWITCHING TO THE CONTROL OF TWO 7,500 H.P. OIL-FIRED COMBUSTION TURBINES. P.T.Carmack and E.M.Smith.
Trans Amer. Inst. Elect. Engrs II, Vol. 79, 157-67 (1960) = Applic. and Industr., No. 49 (July 1960).

Outlines the installation and method of operation of the turbines, and the reasons for choosing static control and largely automatic operation. The logic diagram for the static control is given, with a detailed description of the operation of a portion of it, and an explanation of the symbols used. The layout of the controls is indicated, and the starting and shut-down procedures are described. Since the control equipment was required to operate from a.c. or d.c., static regulators, inverters and switches were necessary, and the circuit diagrams for these are given. Magnetic amplifiers, transistors and controlled rectifiers were used, but some new devices had to be especially developed. The results of two and a half months operation are given. 8 references.
E.F.Hansford

621.316.718

7315 A METHOD FOR COMPUTING THE CHARACTERISTICS OF A D.C. MOTOR WITH THROTTLE CONTROL.
D.A.Alenchikov and V.S.Kulebakin.
Avtomat. i Telemekh., Vol. 20, No. 7, 908-17 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 7, 884-92 (July, 1959; publ. March, 1960).

A method is developed for calculating the characteristics of d.c. electric drives with throttle control. The method is based on the volt-ampere characteristics of the saturable core and its load, and also on the use of operating point trajectories, which are constructed graphically from the family of load volt–ampere characteristics.

621.316.718

7316 ON DETERMINING THE FEEDBACK PARAMETERS FOR A VIBRATION REGULATOR OF ELECTRIC MOTOR SPEED. L.L.Rotkop.
Avtomat. i Telemekh., Vol. 20, No. 7, 918-27 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 7, 893-901 (July, 1959; publ. March, 1960).

A method is presented for determining the parameters of a stabilizing feedback loop of a vibration regulator of electric motor speed. The peculiarities of a contactless relay feedback loop are considered. Examples are given of the determination of the parameters of the stabilizing feedback loop of a vibration regulator.

621.316.718

7317 ASYNCHRONOUS MOTOR SPEED REGULATION BY A VALVE–CONTACT CASCADE CIRCUIT.
I.B.Semenov and Yu.Z.Yarina.
Avtomat. i Telemekh., Vol. 20, No. 8, 1121-8 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 8, 1088-94 (Aug., 1959; publ. April, 1960).

Considers a valve-contact cascade circuit for controlling the speed of an asychronous motor with a phase rotor. The basic relationships are provided, and a comparison with a valve cascade circuit of ion-controlled valves is given. It is shown that, by its principle of operation, a semiconductor diode in conjunction with a series-connected synchronously operating contact is a controlled valve.

621.316.718.5

7318 GRAPHICO-ANALYTIC METHOD FOR COMPUTING THROTTLE CONTROL CHARACTERISTICS OF ASYNCHRONOUS MOTORS WITH LARGE SCHENFER ROTORS. O.B.Rosenbauli and R.N.Rodin.
Avtomat. i Telemekh. Vol. 20, No. 6, 793-8 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 6, 768-73 (June, 1959: publ. Feb., 1960).

A graphico-analytic method is presented for the calculation of throttle control characteristics of asynchronous motors with large Schenfer rotors, and an example is given of the construction of such characteristics.

621.316.719 : 621.77

7319 A METHOD OF BRAKING IN REVERSING PROCESSES. M.N.Fesenko.
Elektrichestvo, 1960, No. 6, 58-61 (June). In Russian.

The usual way of switching reversible rolling mill drives is to drive the generator exciter windings from the difference of two voltages or to switch them by a relay. A faster and more efficient method is suggested, using a transistor d.c. amplifier with an inductive load and the switch in the base input circuit. Oscillographs show unidirectional collector current responses with varying base input voltages. Practical circuits are described, which achieve a clean stoppage of a transient process in the interrupted exciter field by using an intermediate push-pull amplifier with power transistors of up to 150 W dissipation. Speeds of 5000 rev/min are reached from standstill in 0.3 sec, and the reversed process (braking) in 0.24 sec. A.Landman

621.316.72 : 621.375.4

7320 CONTRIBUTION TO THE THEORY OF CURRENT AND VOLTAGE STABILIZERS. S.D.Dodik.
Elektrichestvo, 1960, No. 4, 73-6 (April, 1960). In Russian.

A generalized theoretical treatment of stabilization in terms of matrix algebra is given, the basis matrix having the form of

$$\begin{vmatrix} i_L \\ i_2 \\ \cdots \\ i_n \end{vmatrix} \times \begin{vmatrix} z_{11}\, z_{12} \ \cdots\cdots\ z_{1n} \\ z_{21}\, z_{22} \ \cdots\cdots\ z_{2n} \\ \cdots\cdots\cdots\cdots\cdots \\ z_{n1}\, z_{n2} \ \cdots\cdots\ z_{nn} \end{vmatrix} = \begin{vmatrix} u_{in1} \\ u_{in2} \\ \cdots\cdots \\ u_{inn} \end{vmatrix}$$

where i_L is the load current of the stabilizer, $u_{in\,1} \ldots u_{in\,n}$ are input signals to the stabilizer and potentials operating within same, and $z_{11} \ldots z_{nn}$ are various coefficients having the dimension of resistance. Simplified formulae are derived for voltage and current stabilization and applied to the practical example of single-stage transistor amplifiers. Current stabilization is achieved mainly by feeding the base of the amplifier from the emitter load of a stabilizing transistor; the voltage stabilization does not require a separate transistor, but relies mainly on a non-linear element in the base potentiometer, the output being taken from across the emitter load. Stabilization coefficients are calculated and then output impedances in terms of r_e, r_b and α of transistors employed. A.Landman

621.316.72 : 621.313.32

7321 ON THE SIGNIFICANCE OF STABILITY CRITERIA FOR AUTOMATIC EXCITATION CONTROL OF FREE-RUNNING SYNCHRONOUS MACHINES. L.V.Tsukernik.
Avtomat. i Telemekh., Vol. 20, No. 6, 740-7 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 6, 718-24 (June, 1959: publ. Feb., 1960).

The stability of automatically controlled excitation of free-running synchronous machines, running in parallel and not connected to the rest of the energy system, is considered as a necessary (but not sufficient) condition for system stability. It is shown that excitation stability in this mode of operation may be used as an effective preliminary criterion of the permissibility of coupling (for the analysis of the complex energy system's stability) of multi-stand machines, working in parallel, into one equivalent machine.

621.316.72

7322 LOAD–FREQUENCY CONTROL SYSTEM OF THE MANITOBA HYDRO-ELECTRIC BOARD. K.H.Williamson.
Engng J., Vol. 43, No. 7, 66-8 (July, 1960).

A discussion of the control of the interconnection of 3 power plants, rated at 500, 850 and 600 MW. The methods used in various sections of the plant are described. The 3 basic systems are flat-frequency (F.F.), flat tie-line (F.T.L.) and tie-line bias (T.L.B.). In F.F. the control is by means of the frequency and in F.T.L. by means of current. In T.L.B., a section only responds to load changes within itself and not to changes in neighbouring sections. This method is recommended. A short bibliography is added. R.G.Jakeman

621.316.72 : 621.315.051.24

7323 EXCHANGED AND TRANSMITTED POWER REGULATION IN DIRECT-CURRENT-COUPLED SINGLE- OR THREE-PHASE NETWORKS. H.Graner and P.F.Heidinger.
Elektrizitätswirtschaft, Vol. 59, No. 11, 354-7 (June 5, 1960). In German.

When a number of networks is coupled together by means of a direct current link, it must be possible to vary the voltage in order to control the power transmitted. This power must be regulated to suit the operational conditions of the networks in question and is made to depend upon a function of certain network quantities. Frequency or frequency deviation from a desired value are the first to come into consideration for this purpose, followed by rate of change of frequency and the time integral of frequency deviation. Active and reactive power as well as voltage can also be used. Although the use of direct current linkages has in the past been restricted to special cases such as for very long transmission distances or submarine interconnections, it is suggested that their applicability may become more widespread in the future. A.S.Hay

621.316.72 : 621.374.32

TRANSISTOR SWITCHING CIRCUIT FOR POWER REGULATION APPLICATIONS. See Abstr. 6780

621.316.721

7324 CURRENT STABILIZING DEVICES. B.E.Kubyshin and A.N.Milyakh.
Avtomat. i Telemekh., Vol. 20, No. 5, 663-8 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 5, 634-8 (May, 1959: publ. Feb., 1960).

LC devices are described which produce stabilized current in the load independently of variations in the load resistance.

621.316.721

7325 CURRENT STABILIZER HAS WIDE DYNAMIC RANGE. D.Allenden.
Electronic Industr., Vol. 19, No. 5, 87-9 (May, 1960).

The design of a conventional series-tube current stabilizer is often difficult where the load impedance changes widely and rapidly. If a constant-voltage rectifier forms the basic power supply, the series tube(s) must be able to dissipate nearly full load power. The final design, therefore, employs a much greater series-tube capacity than is required under steady load conditions. This situation can be avoided, or at least ameliorated, by incorporating a second feedback loop, operating on some form of input voltage control, whose object is to maintain approximately constant voltage across the series tube(s). Circuit details are given of a stabilizer designed for a space-charge-limited, electron bombardment heating apparatus having a nominal resistance of about 6000 Ω, but in which large reductions, amounting in the worst cases to virtual short-circuit, result from ionization, outgassing and flashovers. H.A.Miller

621.316.721

7326 MAGNETIC CONSTANT-CURRENT REGULATORS. R.Eberhard.
Elektronik, Vol. 9, No. 7, 207-8 (July, 1960). In German.

Designed for 50 c/s a.c., the regulators comprise a gapped choke in series with a saturated reactor, with suitable shunt capacities. This basic circuit maintains the current within 1% for mains variations of ±10%. Further improvement is obtained by a feedback winding on the choke, in parallel with the load. W.G.Stripp

621.316.721 : 621.318.3 : 538.56

7327 A PARTICULARLY SIMPLE CURRENT STABILIZER OF THE HIGHEST GRADE FOR ELECTROMAGNETS. B.Berkes.
Nuclear Instrum., Vol. 3, No. 5, 260-4 (Nov., 1958). In German.

A type of current stabilizer for electromagnets used in nuclear

magnetic resonance experiments is described. A high dynamic stability (1 : 20 000 at 1.6 A, input voltage variations ±5%, load variations 10%) is obtained using a tungsten filament, which represents a stage with an extremely high amplification in the feedback loop. A high thermal stability is provided by means of this diode since it is practically insensitive to normal room temperature changes. In spite of a relatively high time constant of the heater inductance of the magnet, it is possible to obtain a fast response to sudden changes of input voltage. Measurements were made with a precision potentiometer of an accuracy 1 : 100 000 and results agree within 20% with theoretical considerations.

621.316.721

7328 A CURRENT STABILIZER BASED ON THE CONTROL OF ELECTRONIC VALVES BY A CURRENT SIGNAL. L.Hládek and M.Rálek.
Slaboproudy Obzor, Vol. 21, No. 7, 418-21 (1960). In Czech.

The stabilizer is based on the principle that the current distribution between the anode and the screen grid in a pentode can be controlled by magnetic field. In the actual stabilizer two control pentodes are used. These are placed inside suitable coils which are connected in series with the load. One of the pentodes is also provided with a biasing field produced by a permanent magnet. When the load current varies, the anode voltage of one of the pentodes increases and that of the other is reduced. The resulting difference signal is amplified and then applied to a double-pentode output stage, where it counteracts the effect of the variation. The stabilizer operates at 40 mA, has an output resistance of 3.3 MΩ and its hourly stability is $\pm 2.5 \times 10^{-4}$. R.S.Sidorowicz

621.316.721 : 621.318.3

7329 A SCANNING MAGNET-CURRENT REGULATOR FOR MAGNETIC RESONANCE. M.Yagi.
Sci. Rep. Tohoku Univ. First Ser., Vol. 43, No. 2, 74-84 (Aug., 1959).

A manget-current regulator with a scanning device for automatic recording of magnetic resonance was constructed for an electromagnet having an exciting coil of resistance of about 340 ohms. This current supply is stabilized with a regulator consisting of a constant voltage and current regulator. It supplies a maximum current of 800 mA and has a maximum scanning current-range of about 200 mA and current stabilization factor less than about 10^{-4} during the scanning over several minutes. It was used to observe the nuclear magnetic resonance in solids with a comparatively narrow line or the electron-spin resonance spreading over a considerably wide range of magnetic fields and presenting a broad line of several hundreds gauss. The main discussion concerns the current stability.

621.316.722

7330 VOLTAGE REGULATION IN DISTRIBUTION NETWORKS. P.Gaussens and P.Cazalet.
Bull. Soc. Franc. Elect., Vol. 1, 478-96 (July, 1960). In French.

A criterion for measuring the economic importance of voltage fluctuations is defined: it is a power-weighted voltage-deviation factor expressed as per 10^4 KWh. The practical methods of measuring and reducing the deviation factor to a minimum are outlined, using on-load and off-load tap changers, series or parallel capacitors. This is followed by a detailed description of investigations carried on various typical distribution networks. In each case the application of the above method resulted in considerable reduction of the deviation factor. A.K.Podkolinski

621.316.722 : 621.314.6

7331 CHOOSING INDUCTION REGULATORS FOR RECTIFIER CONTROL. P.N.Wise.
Control Engng, Vol. 7, No. 7, 109-11 (July, 1960).

Demonstrates the use of formulae to calculate the regulator range, full-load kVA rating and regulated kVA to achieve a specified regulation. Dry-type regulators are used for supply voltages up to 600 V; above this the regulator is oil-immersed, with an auto-transformer when its output voltage exceeds 17 kV. Several types of current and voltage control are described. E.F.Hansford

621.316.722

7332 AUTOMATIC VOLTAGE REGULATORS FOR SHIPS' AUXILIARY SYSTEMS. I-II. W.J.R.Farmer.
Elect. Times, Vol. 138, 309-12 (Sept. 1); 345-8 (Sept. 8, 1960).

A brief survey of the various types of automatic voltage regulators for the control of marine alternators. The requirements of these regulators are listed and their basic elements are described with the help of circuit diagrams, curves and photographs. Vibrating contact, carbon pile, rocking segment and magnetic-amplifier regulators are considered as well as some more recent developments, such as compounded self-excited alternators, brushless alternators and transistor regulators. Oscillograms and circuit diagrams are provided and parallel operation is briefly discussed. H.Sterling

621.316.722

7333 DESIGNING TRANSISTORIZED VOLTAGE REGULATORS. E.Wilson.
Electronics, Vol. 33, No. 39, 62-5 (Sept. 23, 1960).

This survey article describes transistor voltage regulator circuits for both low- and high-voltage outputs using common-emitter and differential-amplifier comparison elements. J.MacCormack

621.316.722

7334 LINE DROP COMPENSATION AND ITS FUNCTIONS. D.G.Gibson.
Elect. Engr (Melbourne), Vol. 37, No. 3, 52-8 (June 10, 1960).

A detailed discussion of the basic principles of line drop compensation for a transmission line. An extensive numerical example is given. R.G.Jakeman

621.316.722 : 621.314.214.3

7335 VOLTAGE REGULATION BY CHANGING TRANSFORMER TAPPINGS ON LOAD. J.Dyson.
Trans S. African Inst. Elect. Engrs, Vol. 51, Pt 4, 88-104 (April, 1960).

A description of the construction and operation of the resistance-type on-load tap-changer. Typical examples of 3 groups of design are given: (1) single compartment single switch; (2) double compartment metal-clad and (3) double compartment with live diverter switch tank. Test requirements and maintenance are considered. A discussion is added. R.G.Jakeman

621.316.722

7336 VOLTAGE REGULATION IN MODERN AIRCRAFT ELECTRIC POWER SYSTEMS. A.Krausz and H.A.Kahle.
Trans Amer. Inst. Elect. Engrs II, Vol. 79, 121-8 (1960) = Applic. and Industr., No. 49 (July, 1960).

Briefly reviews the requirements of U.S. specifications and equipment for voltage regulation, transient response, voltage modulation and waveform. The synchronous generator is then analysed from the standpoint of the feedback control engineer using Park's equations and signal flow diagrams. The characteristics of the machine and various types of rotating and static exciters as they influence the transient response of the system are discussed. The derivation of a transfer function of a simplified linear generator is given in an appendix to demonstrate the effect of machine parameters and load on gain and time-constant of the generator. There is a list of references and a discussion in which alternative existing methods of determining transient response are recalled and the merits of signal flow diagrams are listed. J.T.Hayden

621.316.722

7337 THE INFLUENCE OF THE SYSTEM CONTROL ON THE GENERATORS IN LARGE POWER NETWORKS. H.Graner and P.F.Heidinger.
Elektrizitätswirtschaft, Vol. 59, No. 9, 265-70 (May 20, 1960). In German.

Discusses in a general way a systematic approach to the problems of combined frequency and load control for large networks subdivided into groups and comprising steam and water-driven generators (such as occur with international power links). A new terminology is introduced and defined; various regulators and controllers are classified according to their functions. Possible methods of solving power system regulation problems are given and illustrated with block diagrams. A.K.Podkolinski

621.316.722

7338 FAST EXCITATION SYSTEMS: LARGE GENERATOR SCHEMES - No. 2, E.E.Co. N.H.Shaw.
Elect. Times, Vol. 138, 267-72 (Aug. 25, 1960).

For previous work, see Abstr. 6590 of 1960. Describes the scheme in outline with simplified circuit diagrams. It uses magnetic amplifiers and a saturating magnetic device as the automatic control reference; precautions are taken to make this relatively insensitive to changes in frequency, but it is considered that small effects due to temperature changes can be accepted and no temperature compensation is provided. The main magnetic

amplifier which excites the control exciter is push-pull Class A-operated with the normal operating condition near the balance point. By using self-excitation (positive feedback) in the control exciter, the full forcing effort of the magnetic amplifier is available during a transient. Rate feedbacks from the control exciter, main exciter and the alternator are used in the control circuit to provide a reasonable damped response. A conventional main exciter is used and all the auxiliary machines, including a 400 c/s alternator for the magnetic amplifier supplies, are driven by the turbine. Additional features such as parallel operation, line-drop compensation and VAr limiter circuits are described. J.T.Hayden

621.316.722 : 621.313.12

VOLTAGE AND CURRENT REGULATION OF GENERATORS WITH PERMANENT MAGNETS. See Abstr. 7156

621.316.722.1 : 621.311.6

7339 STABILIZED DIRECT-CURRENT, HIGH-VOLTAGE SOURCES FOR ELECTRON MICROSCOPES AND RELATED EQUIPMENT. A.Strojnik.
Arch. tech. Messen, No. 291 (Ref. Z. 43-8), 81-4 (April, 1960). In German.

A review article in which the uses of h.v.d.c. sources are enumerated and circuits and techniques used to obtain, smooth and stabilize such sources are considered in detail. 39 references. T.R.Foord

621.316.722.1 : 621.375.3

7340 PRECISE CONTROL OF HIGH VOLTAGE D.C. USING MAGNETIC CONTROLS. P.W.Covert and M.Kramer.
Proc. Nat. Electronics Conf., Vol. 15, 691-7 (1959).

A system using sensitive magnetic amplifiers was devised to replace voltage sensitive relays as the basic element in a d.c. bus voltage regulator. It was desirable to use magnetic amplifiers in order to facilitate changes in bus voltage settings, eliminate the need for recalibration, reduce maintenance, and improve the ruggedness of the basic sensing device. This method allowed the limits to be set by turning rheostats which raised or lowered the reading on miniature indicating meters. One meter read directly in terms of the minimum and maximum bus voltage to be tolerated. The other meter read the "deadband" in terms of the voltage swing to be tolerated. This allowed the switchboard operator to readily adjust the meters to the desired limits and the control scheme would regulate to these limits. The observed sensitivity was ±0.75 V over a voltage operating range of 500 to 700 with no deadband set in. A mechanical relay would have its contacts in almost continuous operation to duplicate this performance. The actual control was effected by causing a tap-changing transformer to raise or lower the a.c. voltage to mercury-arc rectifiers, thus controlling the d.c. output.

621.316.722.1

7341 STATIC CONTROL FOR A MECHANICALLY REGULATED D.C. SUPPLY.
H.J.Abrams and J.F.Brubaker.
Proc. Nat. Electronics Conf., Vol. 15, 698-706 (1959).

A voltage regulator for a 40 kV d.c. power supply, using two high-gain transistor–magnetic amplifier bistable amplifiers and a Varistor detector, is described. The control system is very similar to the well-known balanced beam relay control, except that all-static components are used. Power gains of 10^9 with 20 ms response time and a drift level of 10^{-9} W in the bistable amplifiers reduces the system accuracy to the accuracy of the Varistor reference. Over a limited ambient temperature range (25° to 55°C), trip point accuracy of the system can be held to better than 0.1%.

621.316.722.1

7342 STABILIZATION OF DIRECT VOLTAGE OF AN ACCURATELY DEFINED VALUE. B.Mirtes.
Slaboproudy Obzor, Vol. 21, No. 9, 542-7 (1960). In Czech.

A high-quality stabilizer circuit with a 45 V reference source is described. The device employs two amplification stages based on double triodes and its stability is of the order of 0.01%. A detailed analysis of the circuit is given and its output impedance characteristic is evaluated. It is pointed out, however, that the stabilizer is inadequate for modern electronic instrumentation (e.g. digital voltmeters) in that a Weston cell having a voltage of 1.0183 V at +20°C cannot be used as the reference source. Two new circuits are therefore evolved. Both produce a stable accurate output voltage of 250 V and are provided with automatic zero-correcting circuits. The first of these stabilizers is similar to the original stabilizer with 45 V reference source, except that a deviation of the output voltage is corrected by means of a narrow-band amplifier which is furnished with a vibrator–modulator and amplifies voltage differences between a Weston cell and a fraction of the output voltage change. The second stabilizer employs a single reference source (a Weston cell) and an a.c. amplifier. Detailed circuit diagrams of the stabilizers are given. R.S.Sidorowicz

621.316.722.1

7343 A TRANSISTORIZED D.C. VOLTAGE REGULATOR FOR DIRECT REPLACEMENT OF CARBON-PILE REGULATORS. P.D.Corey and W.O.Hansen.
Trans Amer. Inst. Elect. Engrs II, Vol. 79, 128-35 (1960) = Applic. and Industr., No. 49 (July, 1960).

The usual variable resistance provided by the carbon pile is replaced by a germanium transistor acting as an on–off switch; connected across the generator field is a "complementary" rectifier. By switching the transistor at a relatively high rate and by controlling the "on" and "off" periods, the mean value of the field current is regulated. The inductance of the field is relied on to maintain the field current so that there is negligible modulation of the generator voltage. The principle of operation and considerations associated with the use of germanium transistors and the compatibility with the existing carbon-pile regulator are discussed, followed by a detailed circuit description under the following sections: Zener diode sensing circuit, transistorized static inverter, pulse width modulation control, equalizing circuit, stability and radio interference. Bode diagrams, oscillograms, environmental tests and constructional details of the final design are included. Operational reliability is expected to be 99.9% for a 5-hour mission and 90% for 500 hours. J.T.Hayden

621.316.726 : 621.373

7344 METHODS OF STABILIZING FREQUENCY. T.F.Haffter.
Brown Boveri Rev., Vol. 46, No. 11-12, 656-63 (Nov.-Dec., 1959).

Techniques and practical examples using transistor LC oscillators quartz crystal bridge circuits, and magnetostriction oscillation are described. A packaged magnetostriction oscillator using a nickel-iron alloy resonator has a maximum frequency deviation in the range 10°C–60°C of 1 part in 10^{-8}. Microwave techniques are also discussed where it is indicated that stability factors of 1.5 part in 10^{-5} over the range -30–50°C can be achieved. A.P.C.Thiele

621.316.727

7345 SIMPLIFIED METHOD OF ESTIMATING THE CONDITIONS OF STABILITY RELATIVE TO LOAD. N.A.Mel'nikov.
Elektrichestvo, 1960, No. 6, 10-13 (June). In Russian.

A considerable increase of capacity for power factor correction can lead to instability at the load point and result in voltage surges and stalling of induction motors. Conditions of voltage and capacity are considered and equations for critical values of load parameters are derived on the basis of a simplified circuit with nonlinear elements representing equivalent load. Also derived are expressions for minimum operating voltages for stability. These expressions can be represented graphically and can be used for preliminary investigation of load points where power-factor correcting capacity can upset stability. J.S.Wilson

621.316.728 : 621.311.153

7346 AN OUTDATED PRACTICE: LIMITER OPERATION. J.Tiercy.
Bull. Assoc. Suisse Elect., Vol. 51, No. 13, 650-1 (July 2, 1960). In French.

An objective examination of the three criteria: quality, safety and economy, invariably leads to the conclusion that opening limiters for generator sets used for primary regulation is contrary to the general interest in the case of an interconnected network. Their relinquishment would necessitate neither a significant extra reservoir safety margin nor excessive efforts on the part of watch-keepers and the limiter would return to its original purpose as a protective device against regulator mal-operation. Fruitful efforts have already been made in this direction by Electricité de France and the Bayernwerk. A.S.Hay

621.316.728 : 621.311.25

CONTROL OF NUCLEAR REACTORS. See Abstr. 7137

621.316.74

7347 PRECISION THERMOSTAT.
Y.Hiruta, T.Kawana and T.Shirai.
J. Radio Res. Lab. (Tokyo), Vol. 6, 533-42 (July, 1959).

The construction of a thermostat to contain a quartz crystal used as a primary frequency standard is described. It comprises two ovens, one inside the other, installed in a temperature controlled room: the crystal being mounted within the inner oven. Circuits used for temperature control of the two ovens are explained in detail. It is claimed that a short-time temperature stability of $< 1 \times 10^{-4}$ deg. C is obtained and that a 1 deg. C change of ambient temperature changes the oven temperature by only 3×10^{-4} deg.

T.R.Foord

621.316.74

7348 SIMPLE TRANSISTOR-OPERATED OVEN-TEMPERATURE REGULATOR. E.R.Pike and J.F.Cochran.
Rev. sci. Instrum., Vol. 31, No. 9, 1005-7 (Sept., 1960).

The circuit of a temperature regulator is given, with stability of $\pm 1^{\circ}$C, for an oven with maximum operating temperature of 1500°C and dissipation 100W. Three power transistors are used without d.c. bias, the heater current being regulated by a temperature-sensitive metal wire resistor representing one arm of a Wheatstone bridge. For temperatures below 300°C the use of thermistors is recommended. The sensitivity of the regulator can be improved by introducing a transistor amplifier (circuit given) after the bridge, in which case extreme stability against mains voltage variations is also achieved. For higher heater power more transistors could be connected in parallel.

V.Bradić

621.316.79 : 621.316.825

7349 TEMPERATURE CONTROL BY THERMISTORS.
G.K.Nechaev.
Elektrichestvo, 1960, No. 6, 85-8 (June). In Russian.

Describes a combined control and measuring circuit in which a temperature-sensing thermistor is connected in series with a relay and a thermistor of N-shaped voltage/current characteristic. At a certain temperature the current following the non-linear characteristic suddenly increases to operate the relay. By means of a switch the sensing thermistor can form an arm of a temperature-measuring bridge. The voltage of stabilized power supply and the values of adjusting resistors are determined by computation. An example is given.

P.Szekely

621.316.79 : 536.58

7350 TEMPERATURE CONTROL METHOD FOR USE BETWEEN 4.2° AND 77°K.
J.M.Flournoy, L.H.Baum and S.Siegel.
Rev. sci. Instrum., Vol. 31, No. 10, 1133-5 (Oct., 1960).

A simple system is described for maintaining controlled experimental temperatures between the normal boiling points of helium and nitrogen. No special apparatus is involved other than that normally required for the handling of liquid helium and the measurement of low temperatures. The technique has been used to control the temperature of a resonant cavity to within $\pm 0.2^{\circ}$K, for $T > 20^{\circ}$K, using a copper–Constantan thermocouple and a variable-range recording potentiometer to measure temperature.

PROTECTION

621.316.9

7351 SAFETY AND RELIABILITY IN THE INSTRUMENTATION OF NUCLEAR REACTORS. F.J.Schijff.
Rev. H.F., Vol. 4, No. 10, 223-9 (1960).

Discusses the requirements of electronic circuitry for the protection of reactors. Emphasizes that the fail-safe principle must be adhered to but that special care should oe taken to prevent shut-downs and subsequent fuel poisoning due to the sheer failure of the electronic equipment. Makes several practical suggestions for improvements in electronic technique.

A.E.I.Research Laboratory

621.316.91 . 621.316.57

7352 PROTECTION AND CONTROL OF NETWORKS BY MEANS OF RECLOSING BREAKERS. H.Wegmann.
Bull. Assoc. Suisse Elect., Vol. 51, No. 19, 893-9 (Sept. 24, 1960). In German.

After an explanation of the reclosing programme and the basic design of the apparatus, several examples are given to illustrate the cooperation between the reclosing and various methods of protection in the branch lines or networks. It is concluded that rapid reclosing is possible with all types of network and also with any form of protection, especially the primary over-current release. A discussion is added.

R.G.Jakeman

621.316.925 : 621.313.3

7353 RELAY TECHNIQUES.
A.W.Bowyer.
Elect. Rev., Vol. 167, No. 7, 277-81 (Aug. 12, 1960).

A review of various modern commercial protective systems which by using rectifiers, magnetic amplifiers and transistors provide enhanced protection for alternators and generators. A rotor-angle limitation, circuits for an alternator, transformer protection circuits based on differential protection, together with designs based on harmonic selection are fully described, and circuit diagrams are included.

J.MacCormack

621.316.925

7354 DISTRIBUTION CIRCUIT PROTECTION FOR THE AMERICAN ELECTRIC POWER COMPANY SYSTEM.
W.H.Johnson and T.J.Meier.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 1833-9 (1960) = Pwr Apparatus Syst., No. 46 (Feb., 1960).

Particular practical experiences are dealt with in the coordination of fuse, circuit-breaker and reclosure line protective devices. In one particular example dual coordination of circuit-breakers and fuses on a time–current basis reduced outages to 40% of those before applying coordination. Similar examples and improvements are quoted when circuit reclosures were included for supplementary or back-up protection on a coordinated basis. Various time–current curves for determination of coordination for a specific network are given. Experience appeared to show that errors in coordination are due to the method of application, from which it is inferred that a uniform method is required for providing reasonable coordination and that with change or increase in network loading, conditional requirements for coordination must be reviewed.

R.J.Jordan

621.316.925 : 621.398

CARRIER TRANSMISSION OF SELECTIVE PROTECTION SIGNALS IN HIGH-VOLTAGE NETWORKS. See Abstr. 7007

621.316.93

7355 PROTECTING SEMICONDUCTOR RECTIFIERS.
Elect. J., Vol. 165, No. 5, 268-9 (July 29, 1960).

Gives sufficient information for the user to determine values for capacitors and damping resistors required to suppress voltage surges at the instant of switching off or on the transformer primary. Formulae cover both single- and three-phase circuits. Diagrams show the recommended connection arrangements for various configurations.

P.Szekely

621.316.93

7356 SURGE PROTECTION OF 35-500 kV SWITCHGEAR IN CONTEMPORARY CONDITIONS.
N.N.Belyakov and A.N.Sherentsis.
Elektrichestvo, 1960, No. 7, 51-6 (July). In Russian.

The changes which have taken place in the operation of electricity networks have made it possible to introduce a number of simplifications into the protection of switchgear against surges and some of these simplifications are described. The recommendations are based on actual operating experience over a number of years and relate to protection against direct lightning stokes and against atmospheric overvoltages propagated along the lines. 10 references.

Associated Electrical Industries (Manchester)

621.316.93 : 621.316.57

7357 RAPID RECLOSURE IN MEDIUM-VOLTAGE RING AND MESH SYSTEMS. H.Jüttemann.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 14, 340-3 (July 11, 1960). In German.

Special arrangements are recommended to suit the slower operating time of m.v. switchgear. Distance-protection relays with change-over devices during rapid reclosure are described and the correct staggering of operating times is discussed.

P.Linton

621.316.93 : 621.316.5

7358 RESTRIKING VOLTAGE 33 kV SURVEY — EAST CORNWALL NETWORK. J.S.Vosper.
Rep. Brit. Elect. Res. Assoc., Rep. G/T312, 13 pp. + viii figs (1958).

Describes the first of a new series of investigations on the restriking voltage characteristics of h.v. networks. Previous reports

(see Abstr. 608 of 1955) give estimates of the probable limits of rate of rise of restriking voltage (r.r.r.v.) to be expected on 132 kV and 66 kV systems in the United Kingdom, and an indication, based on available preliminary data, of the probable r.r.r.v.-MVA characteristics on the 275 kV system now in course of erection. An extension of the survey to lower voltage systems having been requested, a start has been made on 33 kV systems. It is the purpose of this report to give the results obtained so far for a fairly simple self-contained 33 kV network. Included in this investigation is an assessmont of the effect of typical loading of the system. The work was carried out using the E.R.A. Network Analyser which is now in a more or less finalized form as far as impedance units and steady-state measuring equipment are concerned. The techniques developed for the present purpose are described in considerable detail, for future reference.

621.316.93 : 621.316.5

7359 STATISTICAL DATA ON SWITCHING SURGES IN THE BRITISH 132 kV GRID. E.L.White and M.P.Reece.
Rep. Brit. Elect. Res. Assoc., Rep. S/T96, 11 pp. + 6 pp. figs (1959).

A survey of overvoltages due to switching operations was made with an automatic oscillograph at three substations. The records obtained, together with others recorded during specially arranged switchings, are analysed statistically to estimate the magnitudes of overvoltage which would most probably be attained or exceeded in a given period on a transformer, a busbar and a line in an "average" substation equipped with bulk-oil circuit-breakers. The highest relative overvoltage recorded was 2.65. This occurred on a transformer during de-energizing, and would most probably be attained or exceeded on any transformer once in ten years. Relative overvoltages due to switching plant other than transformers were noticeably lower. In de-energizing lines, no evidence was found of the "classical" process of progressive voltage build-up. The probability of switching overvoltages causing flashover of substation protective gaps appears to be so low that such flashovers as have been reported are probably related to combinations of plant not present in the average substation. Various mechanisms of production of overvoltages on transformers and lines during de-energizing are considered in relation to magnitudes of overvoltage recorded.

621.316.932

7360 ARCING FAULT PROTECTION FOR LOW-VOLTAGE POWER DISTRIBUTION SYSTEMS — NATURE OF THE PROBLEM. R H.Kaufmann and J.C.Page.
Trans Amer. Inst. Elect. Engrs III, Vol. 79, 160-7 (1960) = Pwr Apparatus Syst., No. 48 (June, 1960).

When arcing faults occur on a low voltage system a resistive load is placed in series with what is substantially a pure reactive circuit. When the current flow is not continuous the conventional method of steady-state analysis is not applicable; a method of calculation is described from which the minimum values of arcing fault current for different classes of faults are determined. It is shown that these figures may be below the normal settings of circuit-breaker overcurrent releases and the effect of these on the layout of protective gear is discussed. M.Rathbone

621.316.933

7361 THE REPRESENTATION OF LIGHTNING ARRESTERS IN MODEL TESTS. G.Vajda.
Elektrie, Vol. 14, No. 5, 163-5 (May, 1960). In German.

The mathematical relations are established by which a model of a high-voltage lightning arrester is determined for use in low-voltage surge tests in practical transmission systems. The voltage characteristics of the model before and after gap flashover are examined analytically and graphically. The test conditions are determined which must be fulfilled for a study of reflection phenomena, direct lightning surges and surges caused by back flashover, and the parallel operation of several arresters with different characteristics. R.H.Golde

621.316.98

7362 THE DISTRIBUTION OF LIGHTNING STROKES ALONG THE ROUTE OF ELECTRIC LINES. F.Popolanský.
Elektrotech. Obzor, Vol. 49, No. 7, 343-50 (1960). In Czech.

Theories on places endangered by lightning strokes are presented. Results of measurements of distribution of strokes along several lines with steel towers, and ground wires are given, as observed with a magnetic rod during a number of years. Using Poissons' probability expression the distribution of repeated lightning strokes at certain places during a long period is calculated It is found that this distribution is quite random. N.Klein

TRACTION . DRIVES

621.33

7363 THE PROGRESS ACHIEVED IN APPLYING AUTOMATIC WORKING TO THE SIGNALLING OF THE DOLE–VALLORBE [FRANCE] LINE. J.Walter.
Bull. Internat. Rly Congr. Assoc., Vol. 37, No. 8, 653-77 (Aug., 1960).

621.335.1

7364 LOCOMOTIVES WITH IGNITRON RECTIFIERS TYPE 2300 OF THE B.C.K. G.Mignon and P.Lamberts.
A.C.E.C. Rev., 1960, No. 1, 2-12. In French.

A detailed illustrated description of these locomotives type B_oB_o built by the Ateliers de Constructions Electriques de Charleroi (A.C.E.C.) for the Bas Congo au Katanga railway. Current is supplied at 22 kV to the contact line and is led through a pantograph to an autotransformer fitted with h.v. under-load tap-changing gear of 20 steps. A secondary winding of this autotransformer supplies current for the auxiliaries. The current taken from the tap-changing gear feeds, by way of a step-down transformer, the ignitron rectifiers arranged in double pairs on each bogey, each pair feeding one of the four traction motors. A smoothing choke is connected in series to each of the motors. The whole of the control apparatus is arranged on the locomotive between corridors, one of them being locked and only accessible if the pantograph is lowered. The locomotives proved to be particularly suitable for accelerating heavy loads. The reason is explained in detail. The auxiliaries (ventilators for motors, transformers, smoothing chokes and brake resistor, oil pump for transformer, coolwater pumps for the ignitrons etc.) are driven by three-phase induction motors fed by an Arno-type phase-convertor.

R.Neumann

621.335.2

7365 SEMICONDUCTOR RECTIFIER CIRCUITS FOR RECTIFIER LOCOMOTIVES. W.A.Golowanow.
Elektrie, Vol. 14, No. 6, 211-14 (June, 1960). In German.

Describes a Soviet patent for voltage regulation. The secondary of a rectifier transformer is divided into a number of independent sections, each feeding a bridge-connected set of rectifiers. The voltage on the traction motor is varied by series and parallel combination of groups. The efficiency remains nearly constant at every speed which makes the system particularly suitable for shunting duty. 4 references. See also Abstr. 3538 of 1959.

P.Szekely

621.335.2

7366 25 kV A.C. ELECTRIC LOCOMOTIVES FOR BRITISH RAILWAYS. W.D.Morton.
G.E.C. J., Vol. 27, No. 2, 71-6 (Spring, 1960).

A detailed illustrated description of these locomotives of type B_oB_o. They are suitable for a.c. supply of 25 or 6.5 kV, 50 c/s. The max. speed is 100 miles/h, continuous rating 3300 h.p. and the max. tractive effort 50 000 lbs. The current collected by a pantograph is led through an air-blast circuit breaker to the main transformer, on top of which is a tap-changing gear to give a total of 38 voltage steps. The transformer has two secondary sections each supplying eight "Com-Pak" mercury-arc rectifiers. Each pair of traction motors is fed in bridge connection by four rectifiers from each secondary. Of the 38 steps provided, 19 are transformer tappings; the other 19 are obtained by inserting resistors in the circuit. The h.v. equipment is accessible only if the pantograph is lowered and the roof earthing gear is operated. R.Neumann

621.335.2

7367 ELECTRIC LOCOMOTIVES FOR 50 c/s WITH SILICON RECTIFIERS. P.Lamberts.
Schweiz. tech. Z. (S.T.Z.), Vol. 57, No. 33, 645-52 (Aug. 18, 1960). In French.

After a historical survey of the development of electric traction, the advantages of d.c. motors with rectifiers over a.c. motors are pointed out. The advantages of dry silicon rectifiers over mercury-arc types are then explained. Performance is discussed and several schematic diagrams are included. R.G.Jakeman

621.335.22

7368 COMMAND AND CONTROL OF DIESEL-ELECTRIC RAILWAY-CARRIAGES. N.N.Costake.
Regelungstechnik, Vol. 7, No. 7, 230-3 (July); No. 9, 312-17 (Sept., 1959). In German.

Diesel-electric carriages need a mechanical, a hydro-mechanical or an electrical system of power transmission between engine and driving wheels. The present article confines itself to command and control of the electrical transmission and surveys the problems occurring therewith. Four states must be considered in laying out the equipment, namely starting, continuous running, running at high speed and braking. To characterize the properties of the control system, graphs are given showing favourable and unfavourable operational ranges of the engine, the connection for starting the engine by means of the main generator, the current–voltage characteristic of the main generator, the maintenance of excitation by voltage-dependent resistors, field weakening characteristics, transmission characteristics for series-parallel connection of the driving motors and characteristics for dynamic braking. Part II describes and illustrates a number of control systems actually constructed. A bibliography of 65 references is given. R.Neumann

621.335.3

7369 SILICON RECTIFIERS IN MAIN LINE SERVICE.
Engineer, Vol. 210, 292-3 (Aug. 12, 1960).

A brief illustrated description of a B_0B_0 dual-frequency locomotive used on the Dunkerque–Basle trains and suitable for the French supply system of 25 kV, 50 c/s and the Swiss system of 15 kV, 16⅔ c/s. Silicon rectifiers replace the excitron rectifiers previously used and a reduction in weight of 3.5 t was obtained by the change-over. Control is effected at h.v. with a tapped auto-transformer winding providing 32 running notches and 2 weak field steps. The rectifiers form a bridge connection across which the two motors are connected in series. One motor each is arranged in each bogie geared to both axles. The auxiliaries are driven by d.c. motors with exception of a compressor driven by an a.c. series commutator motor. A graph shows the two-day duty cycle of the locomotive. R.Neumann

621.335.42

7370 WARM-AIR HEATING OF RAILWAY COACHES.
S.Doppler.
Elektrotech. u. Maschinenbau (E.u.M.), Vol. 77, No. 18, 401-6 (Sept. 15, 1960). In German.

A brief critical comparison is made between steam, electric, hot-water and warm-air heating of railway coaches. The system of warm-air heating adopted by the Austrian Federal Railways is described in greater detail. A central heat-exchanger heated by steam or electricity heats fresh air sucked in by a ventilator through Venetian blinds and filters. The warm air is forced into the compartments through flaps usually arranged below the seats. The amount of heated air is about 20 m^3/h per passenger at an average room temperature of 20°C. The temperature is controlled by two thermostats. Graphs show the principle of the temperature regulation. R.Neumann

621.335.5

7371 CONGESTION MAY REVIVE THE BATTERY CAR.
P.G.Boyd.
Engineering (London), Vol. 190, 178-9 (Aug. 5, 1960).

A plea for the development of a light 2-seater car, capable of 30 mile/h on normal up-hill gradients, with high acceleration to 25 mile/h and with a range of 30 miles, driven from normal commercial storage batteries, recharged from a garage-mounted charger. Every effort would be made to make the operation of the car foolproof. A table showing the losses of a 2.4 ton battery-operated delivery van is given, and it is apparent that apart from the internal battery losses, by far the greatest loss is due to tyre resistance, and a large-diameter, high-pressure tyre is suggested for use with the car, with a geared motor built into the wheel.
W.D.Gilmour

621.337.66

7372 ELECTRICAL GUARD DEVICES FOR RAILWAY ACCIDENT PREVENTION.
Elect. J., Vol. 165, No. 2, 97-8 (July 8, 1960).

Recent American practice is outlined; automatic methods of protection are required on account of the long runs and the unattended stations. To detect loose hanging parts below a train a series of brittle metal detector loops are mounted between the rails where they can be broken by the hanging parts, giving a signal. Other mechanical detectors serve dragging parts, broken wheel flanges and defective wheels. Hot axle-boxes are detected by fixed electrical pyrometers of the thermistor–bolometer type. Other detectors for floods, falls of rock, fires, etc. are positioned to stop the train before arrival at the danger site. E.H.W.Banner

621.34 : 621.313.3

7373 THEORY AND METHODS FOR THE CALCULATION OF ELECTRIC DRIVES WITH SHARP IMPACT LOADING.
D.P.Morozov.
Elektrichestvo, 1960, No. 6, 17-21 (June).

Generalized methods are presented relating to a.c. motors operating pile-drivers and the like. For the purpose of determining optimum motor power, fly-wheel moment, load characteristics and secondary power-losses, formulae are derived for a motor with fixed resistance in the rotor circuit, with contact slip-regulator and with liquid regulator. R.Matthews

621.34

7374 INVESTIGATION OF OPERATION OF ELECTRIC DRIVE OF THE EXCAVATOR EVG-15 ON AN ELECTRONIC MODEL. V.G.Vasil'ev, A.I.Kondratenko, V.P.Lomakin and N.Ya.Tarasova.
Elektrichestvo, 1960, No. 6, 39-41 (June). In Russian.

Open-cast coal-mining excavator type EVG-15 has electric drives for thrust lift and turning. The lift drive uses a motor of 1100 kW. The operation of control circuits for the electric drives has been analysed on electronic models (not described in the article) and the results of investigations are compared on oscillograms with the experiments on an actual excavator. It is shown that electronic models give reasonably good results and are helpful is designing electric drives. A.Woroncow

621.34

7375 THE ELECTRICAL EQUIPMENT OF THE BHILSA STEELWORKS. M.M.Brozgol'.
Elektrichestvo, 1960, No. 7, 5-10 (July). In Russian.

The Bhilsa steelworks, in Central India, was erected with Russian assistance. The initial capacity is 10^6 tons, rising to 2.5×10^6 tons annually. The plant is designed in accordance with Russian standards, having regard to Indian tropical conditions, and follows the Russian safety specifications. Electricity arrives from a 90 MW thermal station sited at a distance of 225 km, in association with a standby factory power station supplying 25 MW. Transmission is on 132 kV 50 c/s. The pumping stations are designed for unattended operation. Low-inertia rolling-mill drives provide high-quality automatic control, with accelerations up to 100 rev/min sec^{-1}. The automatic flying shears are driven from a 1.1 MW 50 rev/min motor, fed from a 1.2 MW 660 V 1000 rev/min generator. Photo-electric control is employed on the slabbing mills to govern take-up speed, maximum speed and deceleration as a function of length of slab. R.Matthews

621.34 : 621-526

7376 AUTOMATIC ELECTRIC DRIVE FOR GRINDING MACHINES WITH FOLLOW-UP FEED.
A.A.Sirotin and V.A.Eliseev.
Elektrichestvo, 1960, No. 7, 15-19 (July). In Russian.

A 20% increase in throughput is claimed following the introduction of the follow-up feed, at the same time providing better working conditions as the result of fully automatic operation of the grinding processes. Seventy-two ball-grinding machines are in operation, with two feed-back circuits governing grinding allowance and grinding-wheel power. Calculation and experimental results indicate preferable grinding conditions when operating at constant speed as against variable-speed operation.
R.Matthews

621.34 : 621.316.718

7377 REGULATING SYSTEM FOR THE DRIVE OF OVERHUNG ROTARY SHEARS. V.Anderle.
Elektrotech. Obzor., Vol. 49, No. 7, 372-9 (1960). In Czech.

The regulating system relates to shears in rolling mills. Synthesis of this regulation system with position control is shown. Arbitrary initial deviations are assumed and optimum transient processes are required in the compensation of the deviations. The electronic part of the regulation system is described. Results of measurements on an experimental drive with 2000 kW are given.
N.Klein

621.34

7378 ALTERNATING CURRENT DIESEL-ELECTRIC PROPULSION EQUIPMENTS. A.Wiart.
Rev. Jeumont, Vol. 52, 205-24 (1959). In French.

Most of the equipments described comprise several (usually 4) Diesel-electric medium-pressure alternators driving a synchronous propeller motor. Reduced propeller speeds are obtained by slowing the Diesels to their minimum of one third, and below that, the motor is wound to run as an induction machine; it also acts as an electric brake prior to reversal. Graphs show variations of propeller torque and power with propeller revolutions during starting, running, braking and reversing conditions. Ship's lighting and auxiliary services are fed through transformers from the paralleled alternators, or, during manoeuvring and in harbour, from one alternator. Remote control is by three levers with mechanical interlocks. Operation, synchronization, excitation, variants for trawlers, tankers with a.c. motor fuel pumps, etc. are fully described with circuit diagrams. H.F.Hunt

621.34 : 621.87

7379 D.C. MAGNETIC CRANE HOIST CONTROL FOR A.C. POWERED CRANES.
A.H.Myles, M.C.Davies and L.J.Srnka.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 207-11 (1960) = Commun. and Electronics, No. 49 (July, 1960).

An examination into the operation of a d.c. series motor with series brake and power-type overhoist limit switch for the hoist drive of an otherwise all a.c.-powered crane. The standard mill-type motor is fed through a rectifier. The characteristics are discussed and the advantages enumerated. R.G.Jakeman

621.34

7380 THE SELECTION OF ELECTRIC WINDER DRIVES FOR THE PAPER INDUSTRY. M.H.Fisher.
Trans Amer. Inst. Elect. Engrs II, Vol. 79, 99-106 (1960) = Applic. and Industr., No. 48 (May, 1960).

A review of the control features and mechanical features of winder drives. Recommendations are made for the selection of winder drive ratings. The requirements for rider roll and slitter drives are discussed, as well as those for winders with electric braking. R.G.Jakeman

621.34

7381 MATCHING LOAD AND DRIVE CHARACTERISTICS. G.G.Helmick.
Westinghouse Engr, Vol. 20, No. 2, 46-50 (1960).

A review of the drive characteristics of various adjustable-speed drives, such as reel-motors, paper mills etc. Curves are given for a large number of instances, showing how the motor characteristic must match that of the drive. R.G.Jakeman

621.34 : 621.316.718.5

7382 VARIABLE-SPEED MULTI-MOTOR DRIVE FOR A STRIP SHEARING MACHINE. I.Földi.
Bull. Oerlikon, No. 338, 20-6 (Feb., 1960).

The three d.c. shunt-wound drive motors of the strip shearing machine described must operate in relative synchronism with each other; they are, therefore, supplied from the same Ward Leonard convertor. Small corrections of motor speed are brought about by varying the motor fields. Electronic regulators are employed to control the strip speed and the relative synchronous operation of the machines. The design, operation and characteristics of the drive are described.

621.34 : 621.316.718.5

7383 THE ELECTROMAGNETIC DRIVE. R.P.Bielkamp.
Westinghouse Engr, Vol. 20, No. 3 71-5 (May, 1960).

A description of the eddy-current type with stationary field coil, including the structural improvements of the "Magnaflow" coupling. Used in conjunction with a squirrel-cage induction motor, the speed may be varied by regulating the excitation. Typical speed–torque curves for varying excitation are given. Automatic speed regulation can be obtained by tachometer feedback control, which is briefly described. Using a 4-pole induction motor, a regulated speed range of 17 : 1 can be obtained. R.G.Jakeman

621.34 : 621.313.1-9

CHARACTERISTICS OF CENTRIFUGAL PUMPS AND COMPRESSORS WHICH AFFECT THE MOTOR DRIVER UNDER TRANSIENT CONDITIONS. See Abstr. 7155

621.34 : 621.313.1

TEMPERATURE RISES IN ELECTRICAL MACHINES WITH SUSTAINED VARIATIONS IN LOAD AND SPEED. See Abstr. 7151

CONDUCTORS . RESISTORS

(See also Semiconductor Materials)

621.315.56 : 621.316.86 : 621.317.336.6

7384 THE IMPEDANCE OF CARBON FILM RESISTORS AS A FUNCTION OF THE FREQUENCY AND THE D.C. RESISTANCE. A.Debei and L.Hechler.
Frequenz, Vol. 14, No. 6, 193-7 (June, 1960). In German.

To measure the impedance, the resistor has one end soldered to a metal plate and the other to a connection to which an alternating voltage is applied. The return path is via a disk resistor of known value and a screening box. The dimensions of the box and the separation between the resistor under test and the metal plate are in a constant relationship to the length of the resistor. Capacitive and inductive reactances are plotted against frequency, and the maximum usable frequencies for various permissible deviations from the d.c. resistance are given. W.G.Stripp

621.315.56 : 621.316.86

7385 PERFORMANCE CHARACTERISTICS OF VERY HIGH VALUE RESISTANCES. R.Miclo and J.Tsoca.
Onde elect., Vol. 40, 249-51 (March, 1960). In French.

Describes the construction of 10^7 - 10^{15} ohm resistances, based on a colloidal dispersion of carbon in gelatine, deposited on glass rod. Curves show the variation of resistance with applied voltage, the temperature coefficient and ageing characteristics. The method of calibration is outlined, and several application fields, such as nuclear physics, are given. E.F.Hansford

621.315.59 : 621.316.825 : 621.317.61

7386 MEASUREMENT OF THE TIME CONSTANT OF THERMISTORS. E.Kuźma.
Arch. elektrotech. (Warsaw), Vol. 8, No. 1, 201-9 (1959). In Polish.

The time-constant of a thermistor is defined as the ratio of its thermal capacity and the heat dissipation coefficient; it has the same value in heating and in cooling. Values of the dissipation coefficient are given for various types of thermistors. Existing methods for measuring the time-constant are listed and a new method is proposed based on the determination of time lapsing between the moment of switching the current and the instant when transient voltage on the thermistor reaches a specified value; this time is measured as the duration of a pulse triggered at appropriate instants. A full schematic of the instrument is given, with component values. Some experimental results are shown for several types of thermistors. J.M.Silberstein

621.315.59 : 621.316.825

7387 ON THE CALCULATION OF THERMISTOR CHARACTERISTICS. N.P.Udalov.
Avtomat. i Telemekh., Vol. 20, No. 6, 825-7 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 6, 800-2 (June, 1959; publ. Feb., 1960).

An analytical method, which follows from equations of thermal equilibrium, is given for calculating the volt–ampere characteristics of thermistors.

621.315.59 : 621.316.825

7388 THERMISTOR TYPE KMT-14. A.L.Burkin, O.N.Filippova and I.T.Sheftel'.
Elektrichestvo, 1960, No. 5, 71-3 (May). In Russian.

While other thermistors produced in the U.S.S.R. can work at up to 180°C, type KMT-14 will operate at up to 300°C. This type is made from cobalt and manganese oxides and can work in high humidity, submerged in water and in highly reactive liquids. Units are produced with nominal resistance values between 510 ohms and 7.5 Megohms at 150°C. A dimensioned drawing illustrates the design. Temperature characteristics are given for three different units. V–A characteristics at various ambient temperatures are shown and applications for temperature control and fire detection are discussed. At 150°C the sensitivity is about 0.4 mW. The time-constant is 5-10 sec for rising temperature and about one minute for falling temperature. Stability of resistance even at 300°C is quite satisfactory after 300-400 hr ageing. J.M.Silberstein

INSULATING MATERIALS
DIELECTRICS

621.315.61

7389 THE DISTRIBUTION OF ELECTRICAL STRESSES IN COMPOSITE INSULATION.
Bui Ai, R.Lacoste and J.Lagasse.
C.R. Acad. Sci. (Paris), Vol. 251, No. 3, 340-2 (July 18, 1960). In French.

Measurement of the potential at the interface of a mica-bitumen specimen agreed with the value derived from the Maxwell–Wagner theory. During the first 100 secs. after applying the voltage the stress distribution was the same for a.c. and d.c. This has an important bearing on the current techniques for testing a.c. machinery with high-voltage d.c. I.D.L.Ball

621.315.61

7390 WEATHER AND STORAGE AGEING OF INSULATING MATERIALS AND THE RELATION TO THERMAL AGEING. L.Kolár.
Elektrotech. Obzor, Vol. 49, No. 7, 360-7 (1960). In Slovak.

Specimens of neoprene, rubber, polythene, p.v.c. and a few other materials were exposed to weathering at elevations varying from 300 to 8500 ft. above sea-level. Statistical results of the decrease in elongation as a function of time are given and ageing due to weathering is compared with the thermal ageing of a few samples. N.Klein

621.315.61 : 621.389

7391 ACCELERATING FACTORS OF THE SIMULATING "CYCLED HUMID HEAT" TEST FOR DIELECTRICS AS COMPARED WITH ATMOSPHERIC EXPOSURE IN HUMID TROPICS. M.Rychtera.
Slaboproudy Obzor, Vol. 21, No. 8, 480-4 (1960). In Czech.

The climatic testing of equipment designed for humid tropics is not usually done under actual field conditions, but in a simulating environment, where the various harmful effects are considerably accelerated. The simulation technique is analysed mathematically. The so-called accelerating factor for a simulating environment is expressed as:

$$K_u = (t/u) = (T/U);\ u < t,\ U < T$$

provided that:

$$\sum_{m}^{1} \Delta_{actm} A = \sum_{m}^{1} \Delta_{modul} A$$

In the above formulae $T = \sum_{m}^{1} t$ is the total exposure time under actual field conditions, $U = \sum_{m}^{1} u$ is the total exposure time in the simulating enviroument, $\Delta_{actm} A$ represents the changes of a parameter under the field conditions and $\Delta_{modul} A$, the corresponding changes under artifical conditions. Comparison of the field and accelerated tests shows that K_u for humid tropics can be 30, if the accelerated test is to be very reliable. Normally, however, it would be sufficient to adopt $K_u = 90$. R.S.Sidorowicz

621.315.612.4 : 539.2 : 537.2

7392 FERROELECTRIC MATERIALS AND THEIR APPLICATIONS. A.Krembeller.
Sylvania Technol., Vol. 13, 42 8 (April, 1960).

A non-mathematical introduction to the theory of ferroelectricity. Applications of the high permittivity, non-linearity, and piezo-electricity of ferroelectrics are briefly discussed. J.B.Birks

621.315.613.1

7393 NEW INSULATING MATERIALS AND PROCESSES FOR THE WINDINGS OF LARGE GENERATORS IN EUROPE AND U.S.A. W.Oburger.
Elektrotech. Z. (E.T.Z.)A, Vol. 81, No. 15, 517-21 (July 18, 1960). In German.

A review of the properties and uses of mica and mica-paper, together with epoxy and polyester resins. A detailed comparison is made between the continuous and discontinuous methods of insulating stator windings. A table is given to show the advantages and disadvantages of each method. Another table shows the type of insulation and varnish recommended for each part. A description is given of the recent materials now being developed in Switzerland, France and Germany. A bibliography is added. R.G.Jakeman

621.315.614.64

7394 THE CHARACTERISTICS OF FLASHOVER ALONG THE LAYERS OF PAPER–OIL INSULATION IN D.C. APPARATUS. M.A.Greisukh.
Elektrichestvo, 1960, No. 7, 77-82 (July). In Russian.

A description is given of an investigation into the effect on paper–oil insulation flashover characteristics of the thickness of the layer of insulation, the design of the edge, the polarity of the voltage, and the temperature during variation of the flashover distance within wide limits. It is shown that the flashover process along layers of insulation in the case of d.c. is very different from that occurring with a.c.
Associated Electrical Industries (Manchester)

621.315.614.64

7395 PERMALEX, A NEW INSULATION SYSTEM.
M.F.Beavers, E.L.Raab and J.C.Leslie.
Trans Amer. Inst. Elect. Engrs III, Vol. 79, 64-73 (1960) = Pwr Apparatus Syst., No. 47 (April, 1960).

Test results show that the use of cyanoethylated kraft paper instead of normal kraft enabled oil-immersed transformers to operate at higher temperatures. The new paper formed less thermal degradation products, and its compatability with other transformer materials was proved; both oil and wire enamel could be thermally upgraded. Tests were based on changes in the tensile and dielectric strengths of the paper, and were conducted on a pilot sample, on a large production run, and when used on 750 VA transformers.
12 references. E.F.Hansford

621.315.615 : 532.7 : 537.2

7396 SPACE CHARGES IN LIQUID DIELECTRICS.
Z.Croitoru.
Bull. Soc. Franc. Elect. (Ser. 8), Vol. 1, No. 6, 362-80 (June, 1960). In French.

Conduction phenomena in dielectrics differ markedly from those in metals, since the presence of local or general space charges results in a non-uniform distribution of electric field. Several methods of measurement of the electric field are described. An optical method using the Kerr electric birefringence enables the electric field to be measured at all points of the dielectric immediately after the application of the potential, or with a certain time-lag. The application of the method to chlorobenzene has shown the existence of important space charges which form mainly at the electrode contacts. Several theoretical and practical results of this are discussed. J.B.Birks

621.315.616.96

7397 SILICONE INSULANTS IN ELECTRICAL PRACTICE.
D.W.Rees.
Elin-Z., Vol. 12, No. 2, 102-6 (June, 1960). In German.

Summarizes the main properties of silicone electrical insulants and reviews their application, with particular reference to Britain, in motors, transformers, cables and heavy industry generally. Economic factors associated with the use of these materials are also considered. T.R.Foord

621.315.616.96

7398 SILICONES AND THEIR PROPERTIES.
M.Wick.
Elin-Z., Vol. 12, No. 2, 106-10 (June, 1960). In German.

A review of the development and use of silicone insulants is given. Experimental information on the electrical breakdown strength, viscosity, tensile strength and power factor is included which illustrates the general superiority of silicone oils, compounds and rubbers over conventional insulating materials. T.R.Foord

621.315.616.96

7399 SILICONE INSULATING MATERIALS IN ELECTRICAL MACHINE CONSTRUCTION. K.Hoffeliner.
Elin-Z., Vol. 12, No. 2, 118-23 (June, 1960). In German.

Advocates the use of silicone materials in appropriate applications, giving comparisons with Class A and Class B materials. The effect of ambient temperature on insulation life and details of materials used in conjuction with silicones are discussed. The use of silicones for wire insulation, tapes, insulating varnishes and protective paints and lubricants are included with a test shedule for "motorettes" and examples of a silicone-insulated motor and a transformer. J.T.Hayden

621.315.616.96

7400 SILICONES, THEIR APPLICATIONS IN ELECTRICAL EQUIPMENT. J.Alvergnat.

Rev. Gen. Elect., Vol. 69, No. 8, 393-401 (Aug., 1960). In French.

Reviews the structure and the important properties of silicone materials and their particular advantages in some fields of electronic and electrical equipment. I.D.L.Ball

MEASURING METHODS ELECTRICAL TESTING

621.317.1 : 629.13.035

INSTRUMENTATION FOR PLASMA PROPULSION.

See Abstr. 7090

621.317.31

7401 DESCRIPTION OF AN AMPLIFIER FOR THE MEASUREMENT OF SMALL PHOTOELECTRIC CURRENTS. A.Abrami.

Mem. Soc. Astron. Ital., Vol. 30, No. 3-4 (1960). In Italian.

A d.c. amplifier for the measurement of small photoelectric currents is described. It was constructed at the Astronomical Observatory of Trieste for the stellar photoelectric photometer. The sensitivity can be varied between 1.8 and 9.0×10^{-10} amp full scale with a zero-stability better than 1%.

621.317.32 : 537.3

7402 A MEASURING DEVICE FOR SMALL D.C. VOLTAGES BY CONVERSION THROUGH A PHOTO-RESISTOR. M.Draschev.

C.R. Acad. Bulg. Sci., Vol. 12, No. 2, 101-4 (March-April, 1959). In German.

The d.c. voltage to be measured is applied across a divider made up from a fixed and a photo-resistor (a cadmium sulphide crystal). Illumination of the photoresistor by a low-frequency light source results in the development of an alternating voltage across the photoresistor, which is then amplified and detected. Preliminary results show that for an input impedance of 10^9 ohm, a long term stability of 15×10^{-6} volts, a time constant of 3 seconds and a linearity of better than 2.5% over the range $0\text{-}600 \times 10^{-6}$ volts is possible. Methods of improving the performance are outlined. N.Murcott

621.317.329

7403 ELECTRICAL ANALOGUE IN AN UNBOUNDED DOMAIN OF A FUNCTION ASSOCIATED WITH A HARMONIC POTENTIAL OF AXIAL SYMMETRY. G.Hacques.

Ann. Assoc. Internat. Calcul Analogique, Vol. 2, No. 2, 57-62 (April, 1960). In French.

Points out that normal analogue computers such as electrolytic tanks are handicapped by their limited physical dimensions and cannot be used for problems in which the boundaries are at infinity. A procedure is indicated here of geometric inversion of such problems leading to a practical electrolytic plotting tank working in inverse space. A.E.I.Research Laboratory

621.317.329

7404 NEW APPLICATIONS OF THE PRINCIPLE OF INVERSION IN EXPERIMENTAL ANALOGUE CALCULATION. G.Renard.

Ann. Assoc. Internat. Calcul Analogique, Vol. 2, No. 2, 69-72 (April, 1960). In French.

Problems arising when unlimited Laplacian fields have to be examined by means of an electrolytic tank can be surmounted by using the principle of inversion. The most interesting region of the field under study can be enlarged and the remainder inverted. A region lying outside a circle inverts into a region enclosed by a second circle whilst the inverse of a region lying outside a square has the form of a four-leafed clover. Other boundary shapes are discussed and the treatment is applied to the study of stream-line flow between turbine guide vanes. A similar treatment can be applied to mesh networks to enlarge the area under observation. A.S.Hay

621.317.33 : 621.315.61

7405 AGING TESTS COMPARE INSULATION. P.Q.Nelson and R.J.Potts.

Allis-Chalmers elect. Rev., Vol. 24, No. 3, 20-2 (3rd Qtr., 1959).

A description of accelerated aging tests on coils wound for 2.3 kV. Comparisons are obtained for Classes A, B and H (silicone-rubber). R.G.Jakeman

621.317.33

7406 A PRECISION METHOD FOR MEASURING HIGH-OHMIC HEAVILY LOADED RESISTORS. H.Helke.

Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 15, 532-4 (July 18, 1960). In German.

A simple method is described for the exact measurement of the resistance of high-ohmic heavily loaded potentiometers. For testing such potentiometers two test resistors or one test resistor and a resistor of known value are connected as a potentiometer. Parallel to one of the test-resistors is a second potentiometer. A Wheatstone bridge may be balanced with the test resistors and the high-ohmic potentiometer under test for two positions of this second potentiometer. The precision of this measurement of the high ohmic potentiometer may be ±0.01%. J.H.W.Arends

621.317.332.1

7407 VARIOUS APPLICATIONS OF IMPEDANCE DIAGRAMS (BUSHBECK AND SMITH). F.Moyano Reina.

Rev. Telecom., Vol. 15, 13-15, 16-19 (March, 1960). In Spanish.

Describes first a simple method of measuring the impedance of medium- or short-wave aerials using a voltmeter and ammeter, the required impedance being calculated and its phase angle determined from the standard transmission-line equation. It is then showing how the calculation can be avoided by the use of the impedance chart due to Bushbeck. A worked example is given. The Smith impedance diagram is then described, and a worked example is given for the design of a lossy line for the termination of a rhombic aerial. A.C.Brown

621.317.332.3 : 621.396.67

7408 MEASUREMENT OF SPECIFIC EARTH RESISTANCE BY THE EQUIVALENT RESISTANCE METHOD. J.Bader and A.Balcerzak.

Arch. elektrotech. (Warsaw), Vol. 8, No. 2, 281-90 (1959). In Polish.

Examines the feasibility of measuring the specific resistance of the earth by a method of equivalent resistance and capacity measurement. The experimental verification of the method shows that the measurement sensitivity of the equivalent capacity is too small for practical purposes whereas the measurement sensitivity of the equivalent resistance is adequate. The specific resistance of the earth was also measured by the Wenner method. The results obtained in the two cases are compared critically. Good agreement exists between the two methods for aerials 5.5 m long, 0.8 m above the ground and 2 m spacing between the sondes. Z.F.Voyner

621.317.333

7409 PROGRESS ON INSULATION TESTING WITH HIGH VOLTAGES. A.Haug.

Arch. tech. Messen, No. 292 (Ref. V 35193-5), 93-4 (May, 1960). In German.

High-voltage testing methods for the detection of faults in insulating materials and in the construction of electrical apparatus are summarized and references given. The measurement of leakage current obtained with direct and alternating test voltages is discussed and test gear described. T.R.Foord

621.317.333 : 621.314.2

7410 CORONA TEST SOLVES DESIGN PROBLEM. E.J.Adolphson and F.J.Vogel.

Allis-Chalmers Elect. Rev., Vol. 24, No. 3, 23-6 (3rd Qtr, 1960).

After stressing the importance of discharges in the deterioration of power transformer insulation, a sensitive discharge circuit using an air-cored transformer is briefly described. A test gap for discharge calibration is also described. An elementary analysis shows the dependence of the apparent quantity of charge involved in the discharges on the capacitance of the testing circuit. H.Dickinson

621.317.333 : 621.315.2

7411 THE DETECTION OF DISCHARGES IN THE INSULATION OF HIGH-VOLTAGE CABLES. H.G.Tempelaar.

Electrotechniek, Vol. 38, No. 16, 403-10 (Aug. 4, 1960). In Dutch.

Internal discharges in h.v. cable dielectrics are due to the presence of voids. An equivalent circuit is shown for the dielectric containing a void. A voltage impulse across the void is given by $\delta U = Ee^{-\alpha t}$, where E is the origin of voltage across the capacitance

of the void. The impulse is propagated in both directions along the cable. The energy developed in a void as a result of a discharge is calculated. Measurements were carried out on a 2.5 km paper-insulated 1 kV lead cable and a 100 m 50 kV oil-pressure cable. Oscillograms are reproduced an l measurements confirm the theory. It is shown that the sensitivity of detection of the discharge depends on the damping in the cable between detector and void and is unaffected by the total capacitance of the cable under test. G.J.N.Beck

621.317.333

7412 EARTH LOOP TESTING. J.V.Gomersall.
Elect. Rev., Vol. 167, No. 5, 177-8 (July 29, 1960).

Amendments in 1958 to the I.E.E. regulations for the Electrical Equipment of Buildings include a new earthing test in Regulation 507 using the line-earth loop. The new test is compared with the neutral-earth loop tests which has also been retained.
Central Electricity Generating Board Digest

621.317.333

7413 BUILT-IN TEST SYSTEM FOR AUTOMATIC FAULT DETECTION. D.H.Breslow.
Electronics, Vol. 33, No. 25, 60-3 (June 17, 1960).

A description of an automatic fault-finding arrangement for testing the modular battery control centre of a missile-control system. Each module of the control centre is monitored by comparator networks. A test set monitors a matrix of the comparator outputs and when it gets an indication of a fault begins to scan comparator outputs until it locates the faulty module. Since outputs of one module become the inputs of another, logical analysis is performed on the d.c. test signals of the various modules. This logic locates the faulty module in cases of multiple failure symptons and allows the system to supply most of its own test signals. Details are given of a comparator network and test set.
H.A.Miller

621.317.333

7414 THE INFLUENCE OF TEMPERATURE ON D.C. INSULATION TESTS ON ELECTRICAL MACHINES. A.Wichmann.
Elektrotech. Z. (E.T.Z.)B, Vol. 12, No. 10, 237-43 (May 16, 1960). In German.

The results of d.c. tests to investigate the ageing of machine winding insulation vary widely with winding temperature. Test results, at varying temperature, on sample coils with Micanite insulation, having shellac, asphalt, epoxy resin or polyester resin as the bonding medium, are presented with the help of curves. Equations are developed which show the relationship between insulation behaviour and temperature, so that test results on a winding can be deduced to a common temperature. This allows ageing trends to be more clearly observed. It is claimed that the results on sample coils are applicable to whole windings. A large bibliography is included.
H.Sterling

621.317.333.4

7415 PULSE RESPONSE PINPOINTS ARMATURE FAULTS. H.R.Weed and S.K.Weed.
Electronics, Vol. 33, No. 24, 70-2 (June 10, 1960).

Production armatures are tested by comparing them with an armature known to be fault-free. Identical current pulses are injected into both armatures whereupon transient response permits fault diagnosis and location. This method gives accurate diagnosis of such faults as mixed leads, wrong number of turns, short-circuits, open-circuits and earths. Furthermore, when testing armatures rather than coils the fault can be pinpointed to a particular armature slot. A variable-voltage power source simultaneously charges two identical pulsing capacitors during alternate half-cycles of the supply voltage. (They are discharged during the other half-cycle). One capacitor is charged to a positive voltage with respect to earth, the other is negatively charged. The capacitors are connected to the external circuit by two hydrogen thyratrons which are triggered simultaneously. A synchronizing capacitor ensures that the thyratrons fire not more than 0.05×10^{-6} sec apart, so that slight phase differences do not lead to erroneous readings. Details of bridge and basic power circuits are given, together with waveform displays.
H.A.Miller

621.317.335

7416 Q-METER MEASUREMENT OF ϵ AND TAN δ OF DIELECTRICS. A.A.Til'vikas.
Elektrichestvo, 1959, No. 11, 77-80 (Nov.). In Russian.

Discusses Q-meter measurements of ϵ and tan δ in the one megacycle region. Formulae (allowing for edge effects) are given for ϵ and tan δ derived from three measurements at one frequency: (1) without a capacitor in circuit; (2) with the capacitor filled with air; and (3) with the capacitor filled with a dielectric. These formulae are approximate and the errors which arise when using them are discussed.
A.Tybulewicz

621.317.335

7417 A NEW CAVITY-RESONATOR METHOD FOR MEASURING PERMITTIVITY. J.K.Sinha and J.Brown.
Proc Instn Elect. Engrs, Paper 3316E, publ. Nov., 1960 (Vol. 107B, 522-30).

The difficulties of the usual cavity-resonator methods of measuring permittivity are discussed, and details are given of a new method which eliminates most of these at the expense of increasing the computation required to interpret the results. The theory of the new method is described in full, and typical examples of experimental results obtained by its use are given.

621.317.335.3

7418 METHODS OF MEASURING THE PROPERTIES OF INSULATING OILS. I. M.Beyer.
Arch. tech. Messen, No. 292 (Ref. V 942-7), 99-100 (May, 1960). In German.

Factors influencing the electric strength, conductivity and power factor of insulating oils are enumerated. An approved electrode arrangement and experimental preliminaries to ensure cleanliness for electric strength measurements are described. Details are given of an a.c. testing apparatus designed to minimize dissociation of the oil when breakdown occurs and typical electric-strength measurements on a transformer oil and on a cable oil are tabulated.
T.R.Foord

621.317.335.3

7419 METHODS OF MEASURING THE PROPERTIES OF INSULATING OILS. II. M.Beyer.
Arch. tech. Messen, No. 293 (Ref. V 942-8), 125-8 (June, 1960). In German.

For pt I, see preceding abstract. The importance of power factor as a criterion of the quality of oil insulants is emphasized and factors, in particular water content, on which it depends are discussed. An approved test cell for determination of power factor, relative permittivity and insulation resistance and their dependence on temperature, is described. High-voltage bridge networks suitable for these measurements are considered in detail and methods of measuring insulation resistance are reviewed: 46 references.
T.R.Foord

621.317.335.3

7420 MEASURING DIELECTRIC PROPERTIES AUTOMATICALLY. P.G.Frischmann.
Electronics, Vol. 33, No. 32, 56-7 (Aug. 5, 1960).

Manually operated systems for measuring dielectric properties as a function of time or temperature are expensive and not always accurate as errors resulting from interpolation can occur. An automatic system provides results continuously, and high heating and cooling rates can be used. A servo system has been designed to work in conjunction with a General Radio 716-C capacitance bridge. The balancing dials are driven by servomotors actuated by the bridge output voltage. Position indicating potentiometers are also coupled to the balancing dials, and feed signals to recorders so that a permanent record of changes in dielectric properties can be provided.
A.S.Hay

621.317.335.3

7421 EQUIPMENT FOR THE MEASUREMENT OF ELECTRICAL AND OTHER PHYSICAL PROPERTIES OF DIELECTRICS IN MEDIA OF ACCURATELY DEFINED TEMPERATURE AND HUMIDITY. M.Rychtera and R.Blahník.
Elektrotech. Obzor, Vol. 49, No. 6, 304-7 (1960). In Czech.

Describes the apparatus with the aid of cross-section drawing and photographs. The temperature varies by about $\pm 0.5^{\circ}$C over the measuring space and by $\pm 0.1^{\circ}$C in time. Spatial variations of the relative humidity are $\pm 2.5\%$ and the time variations about $\pm 0.5\%$. Electric breakdown strength and loss angle of dielectrics can be measured up to voltages of 15 kV.
N.Klein

621.317.335.3 : 621.315.61 : 532.7 : 539.2 : 537.2

7422 SOME DIELECTRIC INVESTIGATIONS AT 3.15 cm AND 8.7 mm BANDS. H.N.Srivastava.

J. sci. industr. Res., Vol. 18B, No. 11, 457-9 (Nov., 1959).

Dielectric constant and dielectric loss of four grades of steatite, two varieties of seedlac, rosin and mustard oil were determined at 8.7 mm; the steatite bodies were also examined for their dielectric constant and dielectric loss at 3.15 cm. The relaxation time of ethyl benzene was also evaluated. These studies showed that steatite is a suitable material for use as a low-loss dielectric in the 3 cm and 8 mm regions.

621.317.337

7423 PRECISE METHOD OF MEASURING THE Q FACTOR OF RESONANT CAVITIES DYNAMICALLY. K.Leibrecht.

C.R.Acad. Sci. (Paris), Vol. 250, No. 24, 3966-8 (June 13, 1960). In French.

Apparatus is briefly described which permits the rapid and precise determination of absorption and dispersion curves of resonant cavities at 9 Gc/s. In the apparatus, a modified Pound discriminator, the impedance of the resonator is compared with that of a tuned crystal assembly by means of a magic tee. The display is on an oscillograph. An accuracy of 1% in Q is claimed. As an example, the change of resistance of copper deposited on steel was measured after a series of thermal shocks.

R.G.C.Arridge

621.317.337

7424 Q OF RESONANT CAVITIES. MEASUREMENT BY PHASE SHIFT METHOD. M.Y.El-Ibiary.

Electronic Technol., Vol. 37, No. 7, 284-6 (July, 1960).

The method, which is regarded as particularly applicable to high Q values, depends on the relationship between the Q and the phase-shift of the envelope of an amplitude-modulated signal, transmitted through the resonator. The signal is modulated at a frequency of several tens of kilocycles using a crystal diode. The phase-shift is compared with that produced by a known RC network.

E.A.Ash

621.317.34 : 621.372.8

7425 MEASUREMENT OF PARAMETERS OF DIELECTRIC LINES AT mm WAVELENGTHS IN AN OPTICALLY COUPLED RESONATOR. G.Schulten.

Arch. elekt. Übertragung, Vol. 14, No. 4, 163-6 (April, 1960). In German.

Resonator method for measuring guide wavelength, attenuation and radial-field extent of dielectric guides is briefly described. The HE_{11} wave was produced outside the resonator and coupled to it by a nearly transparent mirror consisting of a grid of dielectric threads. Measurements were executed at frequencies in the 5 and 8 mm region. Polyethylene threads of various diameters were used as dielectric guides. The guide wavelength was found to differ from the free space wavelength by 0.1–0.001%. The lowest attenuation value of 0.09 dB/m was measured on a thread of 1.3 mm diameter, at the wavelength of 5.17 mm; the radial extent of the field was about 70 mm; the length of the resonator was 3.9 m.

J.M.Silberstein

621.317.34

7426 CONCERNING A METHOD OF MEASURING THE PROBABILITY DENSITY OF A NOISE VOLTAGE, AND THE EXPERIMENTAL VERIFICATION OF APPROACH TO A GAUSSIAN LAW BY SELECTIVE FILTERING. B.Picinbono.

C.R. Acad. Sci. (Paris), Vol. 250, No. 25, 4123-5 (June 20, 1960). In French.

An experimental method is described of measuring the probability law of background noise, which consists of sampling the noise and making an analysis of the sample using an amplitude selector. This method is used to verify the approach to a Gaussian law by selective filtering.

S.A.Ahern

621.317.34 : 621.396.62

7427 FREQUENCY-INDEPENDENT MEASUREMENT OF COMPLEX QUOTIENTS WITH THE GONIOMETER. H.Fricke.

Elektrotech. Z.(E.T.Z.) A, Vol. 81, No. 12, 422-7 (June 6, 1960). In German.

The fundamental principles of such goniometer measurements are described in detail. The resultant field of a goniometer depends on the ratio of the amplitudes and on the phase difference of the currents or voltages applied to the exciter systems, so that the quotient of two quantities may be determined from the spatial dependence of the search-coil output voltage. From observation of the resultant goniometer field, a working diagram can be derived which permits direct reading of complex quotients from the location and amplitude of the minimum of the search-coil output voltage. Typical equipments for use at low frequencies and in the u.s.w. range are described and experimental results are given. See also Abstr. 1357 of 1960.

A.Wilkinson

621.317.34 : 621.397.62

7428 MEASUREMENTS ON TELEVISION RECEIVERS. H.A.Thon.

Elektrotek. T., Vol. 73, No. 24, 401-6 (Sept. 25, 1960). In Norwegian.

The extensive circuitry of a television receiver necessitates the splitting up of the design into separate sections. The design of sections can be solved individually by measurements and from well-defined specifications. A description of the practical planning of some of the numerous measurements necessary is given.

621.317.34 : 621.317.755

7429 MEASUREMENT OF SIGNALS WITHIN THE NANOSECOND TIME RANGE BY MEANS OF A SAMPLING OSCILLOSCOPE. H.P.Louis.

Elektron. Rdsch., Vol. 14, No. 4, 137-8, 143-4 (April, 1960). In German.

The apparatus described is for use in conjunction with an ordinary low-frequency oscilloscope, and is intended for measuring the operating times of very high speed switching devices, e.g. mesa transistors, tunnel diodes. The method is based on the pulse scanning principle, and the time resolution is 0.35 nsec.

C.F.Pizzey

621.317.34 : 621.372.8

7430 THE OBSERVED 50-90 KMC ATTENUATION OF TWO INCH IMPROVED WAVEGUIDE. A.P.King.

I.R.E. WESCON Convention Record, Vol. 4, Pt 1, 28-33 (1960).

A new measuring technique particularly suited to the measurement of low-loss waveguide lines is described. Some measured results which employ this new technique are given for the TE_{01} transmission loss with two-inch improved waveguide. Both the average loss and the random fluctuations over the 50-90 Gc/s band are low. The observed data obtained with long lines, one of solid copper and one all-helix waveguide, is presented.

621.317.34 : 621-52

7431 THE MEASUREMENT OF THE MEAN SQUARE VALUE OF CERTAIN RANDOM SIGNALS. O.L.R.Jacobs.

J. Electronics and Control, Vol. 9, No. 2, 149-58 (Aug., 1960).

Some practical methods of measuring the mean square value of a common class of random signals are analysed. It is shown that for averaging operations an integrator is more efficient than a low pass filter. The variance of estimates is given for certain simple cases when an integrator is used in conjunction with either a squaring device or a rectifier.

621.317.35 : 621.374.4

7432 SOME MEASUREMENTS OF INTERMODULATION AND HARMONIC DISTORTION IN HALL EFFECT MULTIPLIERS BY MEANS OF A MUIRHEAD-PAMETRADA WAVE ANALYSER. E.Cohen.

Muirhead Tech., Vol. 14, No. 3, 19-23 (July, 1960).

The basic principles and construction of a practical form of multiplier are briefly described. To determine the performance an accurate knowledge of the intermodulation and harmonic distortion is essential; the principle causes are tabulated and a method of measurement described in detail. It is found that measurable 2nd and 3rd harmonic distortion is present and one of the main causes is shown to be hysteresis of the core material which forms part of the coil assembly.

A.P.C.Thiele

621.317.351

7433 MULTIPLE INDICATION OF ELECTRICAL MEASUREMENTS. G.Kosel.

Elektron. Rdsch., Vol. 14, No. 7, 241-3 (July, 1960). In German.

Simultaneous oscilloscopic display of different voltages can be provided by square-wave pulses sequentially scanning the individual test points. Suitable methods, such as pulse delay and pulse gating,

are discussed. Pulses are supplied from a source operating on the principle of either pulse delay or pulse gating. A circuit with pulse gating comprises 27 measuring channels. A modulation unit keeps the pulse amplitude proportional to the measured voltages.

J.H.W.Arends

621.317.351

7434 PHASE MEASUREMENTS WITH OSCILLOGRAPHS WITH DIFFERING X- AND Y-AMPLIFIERS.

Elektronik, Vol. 9, No. 1, 20 (Jan., 1960). In German.

The method considered is the phase ellipse (Lissajous figure) method. The phase errors produced by X- and Y-amplifiers of differing frequency characteristics are discussed, and a simple RC-network for connection in the input circuit of one amplifier for correcting the errors is described.

C.F.Pizzey

621.317.39

7435 AN ELECTRONIC SLAVE CLOCK READING DIRECTLY IN SECONDS. K.Seiferth.

Rdfunktech. Mitt., Vol. 4, No. 4, 173-6 (April, 1960). In German.

The clock is intended for use in television studios. It has no moving parts and is completely silent. Hours, minutes and seconds are indicated by six Type Z510 M figure-indicating tubes which are controlled by 52 Z70W relay tubes. The clock is driven by impulses from the station master clock. The circuits are fully described. The power requirement is 23 mA at 430 V.

H.G.M.Spratt

621.317.39

7436 A METHOD FOR SIMULTANEOUSLY RECORDING THE RATE AND AMPLITUDE OF THE BALANCE IN WATCHES AND CLOCKS IN ANY POSITION. G.Glaser.

Z. InstrumKde., Vol. 68, No. 5, 103-9 (May, 1960). In German.

A lamp and lens project a small beam through the balance wheel at an angle to the balance axis. When a spoke of the wheel swings through the beam, its polished surface reflects some of the light to a lens and semiconductor photocell, and an electrical pulse is produced. The photocell is connected in the input circuit of a transistor amplifier, and the rectangular pulses from its output circuit are applied to a commercial electronic timer. The watch movement is mounted so that it can be turned round on a point which is accurately concentric with the axis of the balance. The calibration of the apparatus is explained, and recorded curves given of the variations in amplitude and rate of: (a) a free-swinging balance in two different positions; (b) a driven balance in two positions, and four differing amounts of winding of the mainspring; (c) a driven balance subjected to periodic rotational movement about the balance axis; (d) a driven balance subjected to periodic movements perpendicular to the balance axis; (e) a driven balance subjected to shocks.

C.F.Pizzey

621.317.39 : 621.398

7437 INSTRUMENTATION TECHNIQUES FOR SHOCK TIME-OF-ARRIVAL MEASUREMENTS.

H.M.Sachs, R.Arndt, J.J.Krstansky and S.I.Cohn.

Proc. Nat. Electronics Conf., Vol. 15, 907-19 (1959).

Reviews methods employed in order to obtain data on the close-in shock-wave velocity from underground nuclear detonations. Two basic techniques were employed. One consisted of strings of pressure switches which were closed by the shock front and initiated pulse-generating equipment. The other method employed a Doppler technique at microwave frequencies to sense the rate at which a coaxial cable was crushed by the shock front. The data from both systems were telemetered to remote recording sites, where it was recorded photographically and magnetically. The system and circuit techniques employed in this operation are discussed in detail.

621.317.39

7438 DIGITAL MEASUREMENT OF AXIS-CROSSING INTERVALS. A.J.Rainal.

Electronics, Vol. 33, No. 23, 88-91 (June 3, 1960).

The system described measures all time intervals between axis crossing for a random process to produce digital data useful in theoretical studies of noise. Any of the four possible time interval sets for positive slope and negative slope axis crossing may be selected with variable axis crossing level. Intervals less than 100 μ sec with a probability less than 0.01 may be recorded. The input circuit is a limiter whose output is a train of randomly spaced pulses whose duration equals the random time intervals being measured. A modified Schmitt trigger produces short pulses at axis crossing times which gate clock pulses for time measurement. The output operates a digital printer. Experimental results for white noise passed through a low pass filter are in agreement with theory.

D.J.Truslove

621.317.39 : 539.1.07

7439 ELECTRONIC TIME ANALYZER APPLIED TO THE MEASUREMENT OF THE HALF-LIVES OF METASTABLE NUCLEAR STATES. P A.Tove.

Nuclear Instrum., Vol. 1, No. 2, 95-100 (March, 1957).

An electronic 20-channel time analyser has been applied to the measurement of the half-lives of metastable nuclear states in the 100 μsec region. The electronic circuits are described and measurements principles discussed, with special regard to the possibility of measuring longer-lived states.

621.317.39

7440 WIDELY SEPARATED CLOCKS WITH MICROSECOND SYNCHRONIZATION AND INDEPENDENT DISTRIBUTION SYSTEMS. T.L.Davis and R.H.Doherty.

I.R.E. WESCON Convention Record, Vol. 4, Pt 5, 3-17 (1960).

In a majority of timing applications, a problem exists in setting two or more clocks to agree with one another. Present techniques using WWV or other high frequency broadcasts allow clocks to be synchronized within one millisecond. A method which offers an improvement in synchronization of three orders of magnitude is described. Microsecond synchronization is obtained by use of the Loran-C navigation system as the link between a master clock at Boulder, Colorado and any slaved clock anywhere in the Loran-C service area. The timing system also includes a unique method for distribution of several time code formats on a single u.h.f. channel.

621.317.39

7441 ELECTRODYNAMIC REGULATION OF PENDULUM MASTER CLOCKS. W.Kammerer.

Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 11, 392-7 (May 23, 1960). In German.

The regulating system described is based on the interaction between a permanent magnet carried on the pendulum and a fixed coil which the magnet enters at one end of its swing, the coil carrying current derived from a battery. A variable series resistor permits adjustment of the magnitude of the rate correction, and a reversing switch determines its direction.

C.F.Pizzey

621.317.39

7442 USES OF SONAR IN OCEANOGRAPHY. H.E.Edgerton.

Electronics, Vol. 33, No. 26, 93-5 (June 24, 1960).

An underwater camera is provided with electronic equipment which produces pulses of ultrasonic energy. The distance of the camera from the sea bed is then monitored by measuring the time interval between arrival of direct and reflected signals at the surface.

V.G.Welsby

621.317.39 : 621.385.032.21

7443 A TEST SET FOR DETERMINING CATHODE WARM-UP TIME. J.Wightman and H.E.Wood.

Electronic Industr., Vol. 19, No. 7, 90-2 (July, 1960).

An electromechanical laboratory test set is described which measures the time that elapses between the application of supply voltages and the drawing of a pre-determined anode current. Time intervals of up to one minute can be measured with a reading accuracy of 0.01 secs.

B.Dunford

621.317.39

7444 VELOCITY MEASUREMENT BY MEANS OF THE ELECTROMAGNETIC DOPPLER EFFECT. I.

B.Koch.

Arch. tech. Messen, No. 293 (Ref. V 143-4), 109-12 (June, 1960). In German.

A brief review of the principle of determining velocities by Doppler methods, and measuring techniques using: (a) continuous radiation; (b) pulse-modulated radiation. 61 references.

C.F.Pizzey

621.317.39

7445 DIRECT RECORDING OF WIND SLIP. R.L.Ives.

J. Franklin Inst., Vol. 270, No. 3, 163-74 (Sept., 1960).

Methods of recording directly the relation of two wind speeds, S_1 and S_2, as a difference, $S_1 - S_2$, or as a ratio, S_1/S_2, are here

outlined; the savings made possible by direct recording are summarized; and the limitations of the various equipments (at the present state of the art) are mentioned.

621.317.39

7446 USE OF THE HYDROGEN LINE TO MEASURE VEHICULAR VELOCITY. S.Feldon.
Proc. Inst. Radio Engrs, Vol. 48, No. 9, 1644 (Sept., 1960).

The 1420 Mc/s emissions of radio stars show a narrow line due to absorption by inter-stellar hydrogen. It is proposed that the velocity of a space vehicle in the direction of a star be determined through the Doppler shift of this line. It is estimated that for a system using a 75 foot aerial and smoothing time of 500 seconds, the mid-frequency of the Cassiopeia source could be measured to an accuracy of 150 c/s which would establish a velocity to 70 m.p.h. An outline is given of a suitable receiver-recording system now under construction. W.T.Blackband

621.317.39

7447 INDUCTION TACHOMETER AS AN ANGULAR ACCELERATION TRANSDUCER. S.T.Kazaryan.
Avtomat. i Telemekh., Vol. 20, No. 5, 676-81 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 5, 647-52 (May, 1959: publ. Feb., 1960).

An angular acceleration transducer in the form of an induction tachometer with d.c. excitation is examined.

621.317.39 : 621.313.3

7448 STUDY OF A PRECISION ELECTRONIC TACHOMETER ADAPTED TO THE MEASUREMENT OF THE SPEED OF ASYNCHRONOUS SLIPRING MOTORS. C.Curie.
C.R. Acad. Sci. (Paris), Vol. 250, No. 25, 4126-8 (June 20, 1960). In French.

The alternating voltage existing at the sliprings of an induction motor is passed through a damped LC filter, amplified and applied to an integrating circuit whose output is a unidirectional voltage linearly related to rotor frequency and hence to rotor speed over the major portion of the speed range. The voltage from the integrator is applied to a cathode-follower output stage which operates a voltmeter whose indication is proportional to rotor speed. A correction device is incorporated in the final stage to reduce the effects of nonlinearity in the preceding circuit. The equipment was standardized against an accurate stroboscope, and the errors, including voltmeter scale error, were less than 1% over the speed range 0 to 1500 rev/min. T.J.Anderson

621.317.39 : 539.1.07 : 531.76

7449 AN APPARATUS FOR MEASURING THE SPEED OF PNEUMATICALLY TRANSPORTED GRAINS BY MEANS OF RADIOACTIVITY. C.A.J.Kritzinger.
Nuclear Instrum., Vol. 1, No. 2, 66-70 (March, 1957).

The individual grains were activated with Caesium 137 and shielded scintillation counters 1.8 meters apart used as triggers to start and stop an electronic clock, from which the speed could be easily calculated.

621.317.39

7450 A MEASUREMENT PROCEDURE FOR THE DETERMINATION OF INTERNAL MEASUREMENTS OF A WAVEGUIDE. J.Bachel.
Frequenz, Vol. 14, No. 4, 131-4 (April, 1960). In German.

The essential part of the instrument is a precision plug which can be pushed along the waveguide. The plug carries a probe, the capacitance of which can be measured with respect to the waveguide wall using an a.c. bridge. The variation of the capacitance is a measure of the variation of the waveguide dimension and this can be determined to an accuracy of 1μ. A.E.Karbowiak

621.317.39

7451 A TECHNIQUE FOR MEASURING ECCENTRICITY IN METAL TUBES. B.E.Noltingk.
Instrum. Pract., Vol. 14, No. 7, 749-56 (July, 1960).

The disadvantages of micrometer, ultrasonic, radioactive and magnetic-gauge methods are summarized. In the method advocated the metal to be gauged is employed as an electrical screen. Two coils with pot-shaped ferromagnetic cores are arranged coaxially a short distance apart so that the flux linking them is largely confined to the space immediately between them. When a sheet of conducting material is placed between the coils, the eddy currents induced in it reduce the effective mutual inductance and hence the voltage in the secondary for a given current in the primary. The extent of this reduction depends on the thickness of the sheet, thus providing in principle a means for gauging the thickness of a conductor. If the operation is carried out simultaneously at opposite ends of a tube diameter and the results compared, the eccentricity can be gauged. Details of the pick-up unit and circuit are given and there are graphs showing the relation between eccentricity gauge reading and micrometer measurement for tubes of different metals. The possibility of eliminating the effect of small changes in conductivity and permeability is discussed. H.A.Miller

621.317.39 : 621-526

7452 A HIGH-RESOLUTION MEASURING SYSTEM USING COARSE OPTICAL GRATINGS.
B.J.Davies, R.C.Robbins, C.Wallis and R.W.Wilde.
Proc. Instn Elect. Engrs, Paper 3312 M, publ. Nov., 1960 (Vol. 107 B, 624-33).

Describes a new measuring system using 100 line/in optical gratings, which contains no moving parts and has been incorporated in both continuous-path and co-ordinate-setting control systems. By a method of cyclic switching of four photocells and subsequent filtering of the combined photocell signals, an a.c. waveform is produced which can be compared in phase with a reference waveform, to determine the magnitude and direction of relative displacement between two gratings, and to provide linear interpolation within the pitch of the gratings. Details of the optical mechanical and electronic design are given, and the effects of variables on the accuracy of the system are discussed. Interpolation accuracy within $\pm 2 \times 10^{-4}$ in using 100 lines/in gratings has been achieved in practical systems.

621.317.39 : 531.78

7453 LOW-COMPLIANCE DIAPHRAGM-CAPACITANCE GAUGE FOR MEASUREMENT OF LIQUID PRESSURES OF THE ORDER OF 1 IN. WATER. A.S.Lodge.
J. sci. Instrum., Vol. 37, No. 11, 432-4 (Nov., 1960).

The construction of a compact "diaphragm-capacitance" gauge suitable for pressure measurement in viscous liquids is described. Sensitivities in the range 1 to 12 pF/in. water are obtained by using different diaphragm units, and the overall zero stability is about 0.002 in. water over a few hours. The response time is about 5 s when the gauge is filled with a 50 P liquid and the outlet hole is 0.5 mm in diameter and 2 mm in length.

621.317.39 : 621.389

INTRACARDIAC CATHETER TIP PIEZORESISTIVE PRESSURE GAUGE. See Abstr. 6877

621.317.39 : 621.389

FAST, AUTOMATIC OCULAR PRESSURE MEASUREMENT BASED ON AN EXACT THEORY. See Abstr. 6878

621.317.39 : 621.372.5 : 534.23

THE DUALITY OF THE FOUR-TERMINAL NETWORK EQUATIONS OF ELECTROMECHANICAL TRANSDUCERS AND THEIR ELECTRICAL FOUR-TERMINAL EQUIVALENT CIRCUITS. See Abstr. 6725

621.317.39 : 621.317.733

TRANSFORMER BRIDGES FOR USE WITH RESISTANCE STRAIN GAUGES AND SIMILAR TRANSDUCERS. See Abstr. 6673

621.317.39

7454 SENSITIVITY AND LINEARITY OF CAPACITIVE MEASURING METHODS. E.G.Woschni.
Wiss. Z. Hochsch. Maschinenbau Karl-Marx-Stadt, Vol. 1, No. 1, 61-9 (1958-59). In German.

Changes in capacitance bring about changes in frequency, which are converted into voltage changes. The properties of the transmitter, modulator and demodulator are examined. Three methods are available to improve the arrangement: (1) increasing the relative frequency-change so that the full demodulator characteristics can also be employed with small frequency changes; (2) the transmitter and the modulator are made more sensitive (if possible, with improved linearity); (3) the action of the demodulator is improved, with special reference to mixing with an additional frequency, push–pull modulation of two oscillators with a differential capacitor as transmitter, followed by the formation of the frequency difference of these two transmitters and the use of a discriminator as transmitter. The linearity can be improved by a factor of 10, the sensitivity by a factor of about 10-100. J.Smuts

621 317.39

7455 TOUCH DETECTOR. G.T.Kemp.
I.R.E. WESCON Convention Record, Vol. 4, Pt 5, 33-8 (1960).

The solion touch detector is an electrochemical transducer which responds to very small forces incident on a sensitive diaphragm. It is relatively small in size and requires very little circuitry. The expected life is unlimited under normal operation and the power requirements (in the microwatt range) are extremely small. There are several possible variations on the basic design, some of which practically eliminate the effect of vibration of the housing. The frequency response of the detector is determined by the values of the acoustic elements in the device and the peak frequency is normally selected to be below 200 c/s. The possible applications of the touch detector are primarily those where only a very small force is available for actuating a "switch" and where a simple, rugged device is desirable. This detector is not intended to be a quantitative device, but rather an on–off type "switch".

621.317.39

7456 CAPACITANCE CHANGE INDICATES LIQUID LEVELS. T.L.Greenwood.
Electronics, Vol. 33, No. 34, 66-7 (Aug. 19, 1960).

The change of capacitance between concentric-ring electrodes when immersed in a liquid e.g. kerosene or liquid oxygen, is used to determine the position of the liquid surface. A simple bridge circuit is used and levels accurate to 0.01 in. are obtained. By using a number of vertically spaced capacitance elements, turbine-type rate-of-flow meters may be calibrated. The apparatus which includes long leads between the liquid tank and the detector is claimed to be robust and to operate satisfactorily at very low temperatures. T.R.Foord

621.317.39

7457 AUTOMATIC INSPECTION OF THE POSITION OF THE BOUNDARY SEPARATING TWO MEDIA BY MEANS OF THE PHASE METHOD USING ULTRA-SHORT WAVES. V.B.Brodskii.
Avtomat. i Telemekh., Vol. 20, No. 8, 1117-20 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 8, 1085-7 (Aug., 1959: publ. April, 1960).

A method for the automatic inspection of liquid level, based on the reflection of radio waves, is extended to the case of inspection of the position of the boundary separating two media. It is shown that the method considered allows this inspection to be implemented without essential measurement error when the dielectric constant of one of the media changes within wide limits.

621.317.39 : 621.315.233

7458 DETERMINATION OF THE SOIL CONSOLIDATION IN FILLED-IN CABLE TRENCHES BY MEANS OF RADIO-ACTIVE GAMMA-RAYS. G.Lemm and W.Reusse.
Nachrichtentech. Z. (N.T.Z.), Vol. 13, No. 6, 275-6 (June, 1960). In German.

The apparatus is an improved form of that previously described (see Abstr. 1464 of 1959). In the new form a radial arrangement of the two counting tubes replaces the original arrangement with the tubes perpendicular to the line of the trench. C.F.Pizzey

621.317.39 : 621.315.2

LOCATION OF SUBMARINE CABLE BY SEARCH-COIL METHODS. See Abstr. 7279

621.317.39 : 621.383 : 535.8 : 536.3

7459 ELECTRICAL AND OPTICAL TECHNIQUES IN THE OPERATION OF INFRA-RED DETECTORS. R.H.McFee.
Optica Acta, Vol. 7, No. 1, 35–46 (Jan., 1960).

The potential performance of infrared detectors can be more fully exploited by the use of proper techniques in the associated electrical and optical systems. On the basis of the equivalent circuits of the various detectors as electrical elements, proper input coupling and biasing circuits can be designed. Some of the newer detectors, indium antimonide, for example, require special methods of coupling to take full advantage of the detector's capabilities. Noise characteristics of input circuits are of great importance in many applications. Transistor circuits are readily adaptable to detector amplifiers, including the preamplifier. The great range of detector impedance values encountered demands a variety of input coupling techniques, articularly as applied to transistor amplifiers. The biasing of photoconductive detectors should be designed for the type of application. Optimum design of the biasing circuits for the detection of large signals may differ from the best approaches for threshold signal detection. For applications where wide-band electrical fidelity is required of the detector system, compensation can be applied by several methods to reduce the effects of detector time-constant roll-off. In many optical systems incorporating infra-red detectors, advantages may be gained in effectiveness of the detector by the use of auxiliary optical elements closely associated with the detector. Such optics may take the form of field lenses or incoherent condensation elements, such as "light pipes". The choice among the various methods involves a number of considerations concerning optical, electrical and mechanical design limitations. With the availability of infrared transmitting materials with high refractive indices, such as silicon, germanium and arsenic trisulphide, field lens designs can be made of simple configuration with high relative aperture. Considerable gain in efficiency of some of the infrared detectors can be obtained by the technique known as "optical immersion". The detector element, usually in the form of a deposited film, is maintained in optical contact with the last surface of the field optics. In this manner, improvements in relative aperture, as well as reduction in reflection losses, are accomplished. Optical immersion may be effected by deposition of the detector surface on to the optical element, by cementing the detector to the element with a suitable substance, or by moulding an optical element around the detector.

621.317.39 : 541.18

7460 SMOKE DENSITY INTEGRATOR. R.M.Storey.
Brit. J. appl. Phys., Vol. 11, No. 11, 509-12 (1960).

A simple instrument is described which both indicates and integrates the optical density of smoke in the range 0 to 1.0 optical density per foot. It consists of a detector unit exposed to the smoke and a remote control unit containing the indicator and integrator. A barrier-layer photocell, mounted within the detector unit, is loaded to give a logarithmic light intensity-voltage characteristic, so that a smoke obeying the Beer–Lambert law gives rise to a linear decrease in cell voltage with increasing optical density. Integration is achieved by means of a capacitor charged by the out-of-balance current of a self-rectifying a.c. bridge, in which the impedence of one arm is controlled by the photocell output. The overall stability over twenty-four hours is of the order of ±6%.

621.317.39

7461 MEASUREMENT OF LUMINANCE. J.Krochmann.
Arch. tech. Messen, No. 293, (V423-2), 117-20 (June, 1960). In German.

The underlying theory and the practice of luminance (brightness) measurement are explained. Visual methods are referred to briefly but physical instruments are treated at some length. The use of an attachment to an illumination photometer is described. Methods of calibration, one of them involving the use of a photometric integrator, are explained. There is a short bibliography. J.W.T.Walsh

621.317.39

7462 INSTRUMENTS FOR MEASURING ILLUMINATION: REQUIREMENTS AND VISUAL METHODS. W.Wiechowski.
Arch. tech. Messen, No. 294, (V423-3), 143-4 (July, 1960). In German.

After a discussion of the purposes of an illumination photometer and the precautions to be taken in using it, a generalized description of visual instruments is given. Such matters as colour difference and calibration are referred to briefly. J.W.T.Walsh

621.317.39

7463 TEMPERATURE MEASUREMENT OF FUEL INJECTION NOZZLES. A.J.V.Joseph.
Hawker Siddeley tech. J., Vol. 2, No. 1, 2-7 (Aug., 1960).

Discusses the high temperatures encountered with fuel injector nozzles fitted to small diesel engines and summarizes the various methods used to measure these temperatures accurately, which include the use of temperature-sensitive paints, fusible plugs and thermocouples. The effect of good nozzle shroud design on temperature levels is emphasized.

621.317.39 : 621.313.33

7464 A METHOD OF MEASUREMENT OF THE ROTOR TEMPERATURE OF ASYNCHRONOUS MACHINES BASED GN MEASUREMENT OF SLIP.
F.Andrzejewski and Z.Orzeszkowski.
Arch. elektrotech. (Warsaw), Vol. 8, No. 2, 259-79 (1959).
In Polish, with summary (2 pp.) in English.

Presents a method of defining the mean temperature of the rotor based on measuring the slip taking place from the moment of starting and terminating with condition of thermal equilibrium at P_2 = const. It enables measurement to be made in various operating conditions of the machine and has been carried out on numerous high-power slip-ring machines. Comparison were also made with results obtained from the measurement of resistance-rise.

621.317.39

7465 METHOD OF CALCULATION OF THE INDICATION LAG OF TEMPERATURE DETECTORS IN THE CASE OF PERIODIC TEMPERATURE VARIATIONS. O.Meyer-Witting.
Electrotechniek, Vol. 38, No. 20, 501-7 (Sept. 29, 1960). In German.

If a temperature detector is situated in a periodically varying temperature field, the temperature at the measurement point of the detector will generally show an indication lag compared with the inertialess measurement at the same point. A non-stationary heat flow process is involved. Benken showed that this can be represented on the basis of the analogy between elastic and thermal flows by comparing the telegraph equation with the differential equation for non-stationary heat flow, making certain simplifying assumptions. The method developed gives the indication delay in terms of the material and the design parameters of the temperature detector, as well as the heat transfer for a given temperature variation. G.N.J.Beck

621.317.39 : 621.791.75

7466 THE MEASUREMENT OF TEMPERATURE IN WELDING ARCS. H.C.Ludwig.
Elect. Engng, Vol. 79, No. 7, 565-9 (July, 1960).

Describes the application of a recording spectrophotometer to measure the spectral intensity variation across the arc, hence the relative intensity of the chosen line and so the temperature of the arc. E.G.Knowles

621.317.39 : 621.389

FOREIGN BODY AND KIDNEY STONE LOCALIZER. See Abstr. 6879

621.317.39 : 621.315.1

A POWER-LINE TRANSIENT RECORDED. See Abstr. 7247

621.317.4

7467 SEPARATION OF EDDY CURRENT LOSSES BY MEANS OF THE EDDY CURRENT ELLIPSE. R.Risch.
Scientia Electrica, Vol. 6, No. 2, 75-9 (June, 1960). In German.

The difference between the d.c. and a.c. hysteresis loops is approximated by an ellipse, whose area is a measure of the eddy-current loss. F.F.Roberts

621.317.41 : 538

7468 COUNTER TORQUE QUARTZ FIBER ADAPTATION OF THE CURIE-CHÈNEVEAU TYPE MAGNETIC BALANCE. M.C.Day, L.D.Hulett and D.E.Willis.
Rev. sci. Instrum., Vol. 31, No. 10, 1142-5 (Oct., 1960).

A mechanically simple magnetic balance having sufficient sensitivity to measure diamagnetic susceptibilities has been developed using a permanent magnet. Its operation is based on the twisting of a quartz or Vycor fibre in a direction such as to overcome the effects of the magnetic field. The magnetic field strength is dependent on the position of the magnet with respect to the sample and can be varied by using different magnet settings.

621.317.411

7469 TESTING ELECTRICAL SHEET. W.P.Crawley.
Elect. Times, Vol. 138, No. 10, 339-41 (Sept. 8, 1960).

Describes equipment for measuring the B–H curve and hysteresis loop of a sample of electrical steel under d.c. conditions, designed for routine use by semi-skilled personnel. The apparatus is based on a permeameter developed at the N.P.L. (see Abstr. 778 of 1930; 47 of 1931). A single sheet of steel 28 cm. by 3 cm. is tested; search coils are used to measure H, and leakage flux from the length under test is eliminated by compensating magnetizing windings. Constructional details and a description of the layout of the complete test unit are given. M.R.Dickson

621.317.411 : 538

7470 A SIMPLE FIELD DETECTOR FOR A D.C. PERMEAMETER. C.Q.Adams.
Rev. sci. Instrum., Vol. 31, No. 10, 1119-20 (Oct., 1960).

A two-core flux-gate magnetometer is employed in a simple balanced bridge circuit as the d.c. field detector of a single-strip permeameter. The sensitive magnetometer and simple bridge circuit eliminated the necessity of the complex filter and selective amplifier used in earlier systems and allows operation independent of oscillator frequency stability. The H-measuring system is designed to measure fields from 1 mOe to about 10 Oe with a sensitivity of $\simeq 25\ \mu a/mOe$. Economy and simplicity of construction, circuitry, and operation are its chief advantages.

621.317.42 : 538

7471 A DEVICE FOR THE PRECISION MEASUREMENT OF AN INHOMOGENOUS MAGNETIC FIELD.
G.Bäckström.
Nuclear Instrum., Vol. 1, No. 5, 253-8 (Sept., 1957).

A generator device has been constructed for measuring the field of a β-spectrometer, having a gradient of 1% per cm and a field range 10-300 gauss. A sensitivity of $1 : 10^5$ has been obtained.

621.317.42 : 621.384.612 : 538

7472 ELECTRONIC APPARATUS FOR THE MEASUREMENT OF DYNAMIC MAGNETIC FIELDS. I.F.Quercia.
Nuclear Instrum., Vol. 3, No. 5, 292-7 (Nov., 1958).

An apparatus is described which reproduces with a staircase voltage waveform a magnetic field rising between 0 and about 120 gauss. The device is well suited for the measurement of the instantaneous value of the magnetic field in the gap of an electron synchrotron. It consists of a peaking strip magnetic probe, and an electronic apparatus.

621.317.43

7473 A NULL METHOD FOR MEASURING MAGNETIC HYSTERESIS LOSSES UP TO HIGH INDUCTIONS.
L.Mollwo.
Elektrie, Vol. 14, No. 4, 135-7 (April, 1960). In German.

The method is based on a bridge circuit, and uses a 50 cm Epstein-square with a 10 kg core; it is suitable for measurements with densities up to 1.8 Wb/m^2. The core is provided with primary and secondary windings, each of 600 turns, and a 0.05Ω standard resistor is connected in series with the primary coil. A 6000Ω adjustable resistor forms the third, and a 0.5Ω standard resistor the fourth, arm of the bridge. The balance detector is a high-sensitivity, light-beam wattmeter (0.18 W/scale div.). The voltage circuit of the wattmeter is connected across the secondary coil; the current coil is connected in series with a 100Ω resistor and the combination connected between the junction of the 0.05Ω resistor and the primary winding, and the junction of the third and fourth bridge arms, i.e. the coil and resistor are in the detector diagonal. Balance of the bridge is effected solely by adjustment of the 6000Ω resistor. In the example given, the limits of adjustment are 5640 and 7000Ω. A dynamometer null indicator gives a sharp balance indication in the presence of strong harmonics, and its operation under such conditions is discussed. C.F.Pizzey

621.317.44

7474 MEASURING SWITCHING SPEED OF MAGNETIC FILMS. W.Dietrich and W.E.Proebster.
Electronics, Vol. 33, No. 23, 79-81 (June 3, 1960).

Describes apparatus to measure the flux reversal waveform of Permalloy films 0.1μ thick which switch in 2 ns inducing about 0.5 V in a single turn loop. Pulsed magnetic fields up to 10 Oe with very fast rise time are generated between the plates of a short-circuited strip-transmission line by the discharging current of a previously charged coaxial line. The flux change in the thin film specimen between the plates of the strip-line is detected by a probe and fed to a special sampling oscillograph. The methods adopted to cancel spurious pickup are discussed. Switching curves in the nanosecond region are given. D.J.Truslove

621.317.44

7475 MAGNETIC MEASUREMENTS IN SPACE. D.Mansir.
Electronics, Vol. 33, No. 32, 47-51 (Aug. 5, 1960).

Starts by outlining the objections of sending magnetometers into space. Describes magnetic measurement made from the Vanguard III satellite using a proton precession magnetometer which is described, together with a circuit showing how control is obtained. Future satellites will use optically pumped alkali-vapour magnetometers whose principles are outlined. A.C.Brown

621.317.44 : 621.318.132

7476 ON A MEASURING SYSTEM FOR DETERMINATION OF THE PERMEABILITY TENSOR AND THE DIELECTRIC CONSTANT OF FERRITES AT 3000 Mc/s. W.Nowak.
Hochfrequenztech. u. ElektAkust., Vol. 69, No. 3, 83-94 (June, 1960). In German.

Presents the theory of ferromagnetic resonance and its application to the measurement of magnetic susceptibility and permeability tensors of small ferrite probes. Influence of the shape of the probe is discussed. This apparatus consists of a circularly polarized resonator which is coupled at each end face to a rectangular waveguide, the waveguides being at right angles to one another. The theory of this type of coupling is outlined. The resonator is placed at the centre of a forced-air cooled electromagnet capable of producing a field of 4200 A/cm for short periods. A frequency-stabilizing scheme generates an excitation of nearly 3 Gc/s, adjustable with an accuracy of 10 kc/s. Some experimental results are given with ferrite sphere of 3 mm diam. lowered into the resonator via the coupling holes. 20 references. Z.A.A.Krajewski

621.317.44

7477 MASS-PRODUCTION TESTING OF TOROIDAL CORES FOR BASIC FERROMAGNETIC PROPERTIES. E.L.Kantor.
Priborostroenie, 1959, No. 11. In Russian. English translation in: Instrum. Constr., 1959, No. 11, 23-4 (Nov.).

Describes a method of production testing of ferromagnetic cores in alternating magnetic fields, in which the hysteresis loop of a standard reference, and the sample under test, are displayed simultaneously. Main distinguishing features of the instrument described (Ferrograph) are: (1) high efficiency; (2) wide frequency band; (3) wide range of flux densities. Accuracy of testing is claimed to be not worse than ±4%. A.C.Brown

621.317.44

7478 PULSING HALL PROBES FOR GREATER OUTPUT. D.L.Shirer.
Rev. Sci. Instrum., Vol. 31, No. 9, 1000-1 (Sept., 1960).

The application of indium arsenide–phosphide Hall probes for magnetic-field measurements is discussed. The precision of commercial types is limited to about 0.25% because of the maximum control current, power dissipation, and the equivalent input noise of the subsequent amplifier. An improvement to better than 0.03% is achieved by control current pulses, of up to 50 ms duration, 10-20 times greater than continuous current. The amplified Hall voltage is applied to an amplitude comparator or digital voltmeter. The method is suitable for precise determination of the moment when a rapidly changing field reaches a given value. V.Bradić

621.317.6

7479 Z-AXIS MARKER GENERATOR FOR BANDPASS CIRCUIT ALIGNMENT. D.J.Odorizzi.
Electronics, Vol. 33, No. 26, 108-10 (June 24, 1960).

This marker generator provides high-intensity spots at any desired frequency within the range 8-22 Mc/s on a band-pass response curve appearing on a c.r.o. screen. The swept-frequency oscillator employed, feeds both the circuit under test and also an amplifying stage. The output load of this stage is a variable high-Q tuned circuit which is followed by a detector, a peaking stage and an output stage. When the oscillator frequency coincides with that to which the tuned circuit is set, a sharp pulse is delivered by the output stage. This pulse is applied to the grid-cathode circuit of the c.r.t. to brighten up the trace. H.G.M.Spratt

621.317.6 : 621.385.832

7480 MEASUREMENT OF THE NON-LINEARITY OF THE DEFLECTION FACTOR OF OSCILLOSCOPE TUBES. K.P.Beisse.
Elektronik, Vol. 9, No. 5, 129-31 (May, 1960). In German.

The non-linearity is defined as the deviation of the deflection factor, for 75% of the usable radius, from that for 25% deflection. The arrangement described comprises a housing for the tube with a compartment containing four photo-electric cells. Between the c.r.t. screen and the cells is a plate with a central aperture and other holes on four radii. The correct deflection is arrived at by applying a small alternating voltage to the deflecting system perpendicular to the deflection to be measured, thus producing a short line scan. The line is then deflected in the desired direction and the p.e. cell output goes through a maximum when the line is positioned centrally in front of the appropriate aperture. The deflecting voltage is measured and the deflection factor calculated. W.G.Stripp

621.317.61

7481 AN EQUIVALENT CIRCUIT DIAGRAM FOR THE GLASS-ELECTRODE (pH) MEASURING CELL. R.Süss.
Arch. tech. Messen, No. 292 (Ref. V 332-21), 89-92 (May, 1960). In German.

A simplified diagram is developed, which, although not exact, gives sufficient accuracy for its application to nearly all practical cases. C.F.Pizzey

621.317.61

7482 A CONTACTLESS METHOD FOR MEASURING SPECIFIC IMPEDANCE AND GEOMETRIC DIMENSIONS BY MEANS OF EDDY CURRENTS. V.P.Grabovetskii.
Avtomat. i Telemekh., Vol. 20, No. 7, 946-54 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 7, 921-9 (July, 1959; publ. March, 1960).

Considers a contactless method for measuring the electric specific impedance of nonmagnetic materials and the geometric dimensions of large specimens of these materials. The relationships are provided which relate the introduced impedances and the parameters of the specimens, when the specimens have the form of cylinders, prisms and blocks with plane surfaces.

621.317.61

7483 USING NUCLEAR RESONANCE TO SENSE TEMPERATURE. C.Dean.
Electronics, Vol. 33, No. 28, 52-4 (July 8, 1960).

A radio-frequency spectrometer suitable for determining the change of resonance frequency with temperature is described. Suggestions are given regarding materials with suitable nuclear resonance frequencies, together with suggestions of modifications which might be made to the r.f. spectrometer. E.G.Knowles

621.317.61

7484 TRACING TUNNEL DIODE CURVES. H.G.Dill and M.R.MacPherson.
Electronics, Vol. 33, No. 32, 62-4 (Aug. 5, 1960).

Analyses the impedance conditions required in the test circuit and mounting to avoid h.f. oscillations during testing, and describes a mounting and test circuit using germanium resistors. F.F.Roberts

621.317.61 : 621.382.333

7485 TRANSISTOR MEASUREMENT TECHNIQUES. W.v.Münch.
Fernmelde-Ingenieur, Vol. 14, No. 7, 30 pp. (July 15, 1960). In German.

A thorough, systematic and up-to-date survey of transistor measurement techniques is presented, supported by a brief bibliography. After an explanation of h and y parameters, modern electronic curve-tracing equipment is described for simultaneous display of characteristics such as I_C versus V_C with I_e, I_b and V_{be} as parameters. Measurements of h parameters at low frequencies are described next, by a.c. signal application and by graphical methods, detailed information being given on multi-purpose switchable test equipment for reading h_{11}, h_{12}, h_{21}, h_{22} and h_{21}'. Most suitable bridge configurations are also reproduced and discussed. H.F. characteristics are then treated, following the Giacoletto equivalent circuit, and compensation and bridge measurements of complex admittances, r_{bb}', capacitances and cut-off frequency are discussed. Final chapters deal with d.c. amplifier parameters, thermal resistance measurements and stability criteria and with the evaluation of the noise factor at varying frequency. A.Landman

621.317.61 : 621.316.825 : 621.31[illegible]

MEASUREMENT OF THE TIME-CONSTANT OF THERMISTORS. See Abstr. 7386

INSTRUMENTS
MEASURING APPARATUS

621.317.7

7486 METHODS AND INSTRUMENTS FOR THE MOST ACCURATE MEASUREMENT OF A.C. CURRENT, VOLTAGE AND POWER. A.Ebinger.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 15, 360-6 (July 25, 1960). In German.

Several direct-reading instruments with an accuracy of 0.1% are described. Further improvement is achieved by balancing the a.c. value against a d.c. value which can be measured more accurately; errors as low as 0.01% appear possible. P.Linton

621.317.7 : 621.315.59 : 537.7

7487 APPARATUS FOR MEASURING AND RECORDING THE RESISTANCE OF SEMICONDUCTORS IN $\log R = f(T^{-1})$ COORDINATES. L.G.Sapogin and V.M.Ivko.
Fiz. tverdogo Tela, Vol. 2, No. 7, 1482-8 (July, 1960). In Russian.

Alternating currents in the range 20 c/s to 20 kc/s were used, with a 12-valve logarithmic amplifier for measuring the e.m.f. from probes on the specimen, and a 2-transistor plus 7-valve hyperbolic amplifier for measuring the e.m.f. from a thermocouple on the specimen. The outputs may be fed to a two-coordinate recording device. Full circuit details are given, and some results quoted. Among the advantages claimed are: (a) rapidity of measurement, avoiding irreversible changes in the specimen; (b) zero average thermo e.m.f. in the probe circuit; (c) ease of detection of zones of high resistance, from variation of resistance with frequency; (d) the width of the forbidden zone can be found directly from the shape of the recorded characteristic; (e) the possibility of simultaneous recording of any hysteresis present. F.Quelon

621.317.7

7488 SOLVING PICKUP PROBLEMS IN ELECTRONIC INSTRUMENTATION. W.McAdam and D.Vandeventer.
I.S.A. J., Vol. 7, No. 4, 48-52 (April, 1960).

Pickup is defined as any voltage or current in the measuring circuit which is fundamentally not part of the signal to be measured, and which adversely affects accuracy of measurement. It is stated that the usual forms of pickup occur in four frequency bands, supply mains frequency and harmonics, low-frequency noise, direct-current pickup and radio-frequency pickup. The term "direct-current pickup" is, contrary to accepted usage of the word "pickup", applied to internally generated voltages such as thermo-e.m.f.'s., corrosion potentials due to electrolytic action and contact (Volta effect) potentials. Methods of eliminating or compensating the various forms of pickup are discussed. C.F.Pizzey

621.317.7 : 621.384.612 : 537.54 : 539.1.07

7489 CERN MEETING ON NUCLEONIC INSTRUMENTATION FOR HIGH ENERGY PHYSICS. Edited by G.von Dardel.
Nuclear Instrum., Vol. 2, No. 2, 73-218 (Feb., 1958).

The conference was held from 30 Sept.-2 Oct., 1957 to discuss the instrumentation required for the high energy accelerators coming into operation in various parts of Europe. There were six sessions dealing with the following topics: (1) nanosecond techniques; (2) country and storage systems; (3) and (4) information handling systems and other problems of big experiments; (5) transistor circuits; and (6) standardization of nuclear equipment. Abstracts of some of the papers will be found in this or succeeding issues of Science Abstracts.

621.317.714

7490 LOGARITHMIC MICRO-MICROAMMETER. M.C.Kopp and S.F.Pinasco.
Rev. Electrotec., Vol. 46, No. 4, 121-6 (April, 1960). In Spanish.

A circuit having a logarithmic response covering 6 decades of input current from 10^{-13} to 10^{-7} A is described. The logarithmic element is a diode-connected electrometer valve whose filament is supplied with d.c. by making it part of the feedback arrangement. T.H.D.Attewell

621.317.723

7491 VACUUM TUBE ELECTROMETERS USING OPERATIONAL AMPLIFIERS. G.F.Vanderschmidt.
Rev. Sci. Instrum, Vol. 31, No. 9, 1004-5 (Sept., 1960).

Describes two general purpose electrometers using operational amplifiers. In each circuit, after the input stage which consists of two low grid-current valves, a commercial type operational amplifier is used. In both cases the output of the amplifier is fed back to the input and very small drift is achieved. One electrometer is battery operated and includes a transistor operational amplifier; the other uses a valve amplifier. V.Bradić

621.317.725

7492 NOVEL DESIGN PEAK VOLTMETER. R.P.MacKenzie.
Electronics, Vol. 33, No. 25, 57 (June 17, 1960).

A peak-reading transistor voltmeter, intended for use at low duty cycles where conventional methods become difficult, uses a monostable multivibrator, turned on for a substantial portion of the input interpulse period, to charge a conventional Miller type integrating capacitor if the peak input voltage is below the voltage already stored on the capacitor. If the input voltage is greater than the capacitor voltage, the multivibrator remains quiescent, and the charge on the capacitor is reversed by a d.c. level setting voltage. No figures for accuracy are given. W.D.Gilmour

621.317.727.1

7493 NEW CONSIDERATIONS ON THE BEHAVIOUR AND TESTING OF VOLTAGE-DIVIDERS FOR THE MEASUREMENT OF VERY HIGH RAPIDLY CHANGING IMPULSE VOLTAGES. K.Berger and A.Ašner.
Bull. Assoc. Suisse Elect., Vol. 51, No. 16, 769-783 (Aug. 13, 1960). In German.

A detailed theoretical and experimental approach to the problem of measuring rapidly changing high-voltage impulses with the aid of potential dividers. The theoretical part outlines the usual procedure for the determination of errors, due to the potential divider and its associated connections, when measuring rectangular pulses. This is followed by a new method of calculating these errors in terms of the harmonic response of the measuring circuit. In the experimental part results are given which show close agreement with the theoretical predictions. A method of correcting the errors by means of a differential amplifier is described. H.Dickinson

621.317.727.1

7494 THE KELVIN–VARLEY VOLTAGE DIVIDER. J.B.Kelley and H.H.Marold.
Instrum. Control Syst., Vol. 33, No. 4, 626-8 (April, 1960).

The principle of the Kelvin–Varley voltage divider is explained, and a 6-dial divider with a total resistance of $10^8\,\Omega$ and a resolution of 1 part in 10^6 described. C.F.Pizzey

621.317.73

7495 AN ELECTRONIC MOISTURE-MEASURING INSTRUMENT. K.Brauser and L.Hübschen.
Elektronik, Vol. 9, No. 5, 143-4 (May, 1960). In German.

The moisture content is found by measuring the resistance of the sample in series with a known resistor. The voltage across the known resistor is applied to the grid of the input stage, which has a pentode as a variable leak to extend the range of the switched fixed resistors. The applied voltage is a rectangular wave, and the amplified and integrated output drives a meter and a pen recorder. The samples are placed in a Plexiglas container with probes. The range is from 10^3 to 10^7 ohms. W.G.Stripp

621.317.73

7496 A NEW Z-φ IMPEDANCE MEASURING INSTRUMENT. J.O.Nielsen.
Ingeniøren C, Vol. 4, No. 2, 37-45 (June, 1960).

Describes the principles of a new type of impedance measuring instrument similar to the well-known Grützmacher impedance measuring bridge, and characterized by a simple and rapid adjustment procedure, direct reading of $|Z|$ and φ, a wide measuring range (1 Ω to 1 MΩ), a wide frequency range (30 c/s to 300 kc/s), a wide test-current range (1 μA to 1 A), and an accuracy of measurement better than 1% and 0.5°. The new instrument is also applicable to measurements of balanced-to-earth impedance, and to measurements with superposed d.c. A theoretical discussion of the systematic errors of measurement is given, and the magnitudes of such errors are estimated.

621.317.733

7497 A HIGH-VOLTAGE BRIDGE FOR POWER-CIRCUIT CAPACITORS. M.Preisinger.
Arch. tech. Messen, No. 293, R73-R76 (June, 1960). In German.

The bridge circuit, which incorporates mutually coupled inductive ratio arms of variable ratio, enables comparison of a test capacitor against a standard capacitor. The theory of the bridge is given and a circuit to compensate for the power factor of the standard capacitor is explained. Practical details of the construction and arrangement of the components are included. It is claimed that the bridge, which is designed for use at voltages up to 2000 V, measures capacitance in the range 0.9 to 203 μF with an accuracy of 1% and power factors up to 0.1 with an accuracy of 2% or $\pm 2 \times 10^{-4}$ whichever is greater. Inductance may also be measured with this bridge. T.R.Foord

621.317.733

7498 THE LOADING CAPACITY OF NON-LINEAR BRIDGES. L.Gádor.

Acta tech. Hungar., Vol. 28, No. 3-4, 281-307 (1960).

A detailed examination of the performance of a.c.-energized bridges composed of non-linear impedances and operated near the balanced state, and with loading across the bridge. The application of the results to the dimensioning of bridges for specified performance is discussed. C.F.Pizzey

621.317.733

7499 TRANSISTOR COMPARISON DEVICES. V.M.Polyakov.

Avtomat. i Telemekh., Vol. 20, No. 5, 673-5 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 5, 644-6 (May, 1959: publ. Feb., 1960).

Comparison devices of the null-element type using transistors and with high reliability, small dimensions, and low power requirements are considered.

621.317.733

7500 USING OFF-BALANCE BRIDGES FOR MEASUREMENT AND CONTROL. G.Revesz.

Electronics, Vol. 33, No. 27, 52-4 (July 1, 1960).

The detector current in unbalanced bridge networks is, in general, a non-linear function of a change in value of any of the bridge components. This non-linearity is analysed and illustrated for the particular case of a capacitance bridge with coupled inductive ratio arms having a ratio of unity. It is shown that if an inductor is included in the detector branch an improvement in linearity and sensitivity is obtained making the unbalanced bridge a useful control device. A numerical example is given. T.R.Foord

621.317.733

7501 CHARACTERISTICS OF A PRACTICAL HARMONIC MEASURING BRIDGE. L.F.Roehmann.

Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 12, 434 (June 6, 1960). In German.

The degree of interference with communication networks produced by an electrical installation is determined by the static generated. It is often advantageous, however, to measure or record the contribution made by the different harmonics and sub-harmonics as well as changes occurring when the circuit configuration is altered. The bridge described has been developed for this purpose. The current flowing in the diagonal of the bridge, which is measured and recorded, is the product of a constant real amount and a complex frequency dependent quantity. The bridge is tuned so that this current is zero at 50 c/s. The bridge error is zero below 3 and above 800 c/s so that d.c. calibration or calibration at 800 or 1000 c/s is possible. A.S.Hay

621.317.733

7502 LOW-RESISTANCE MEASUREMENTS. L.F.Roehmann.

Instrum. Control Syst., Vol. 33, No. 4, 630-1 (April, 1960).

The principle of the Kelvin bridge is explained, and a form described which is suitable for measuring the resistance of busbars carrying heavy current, e.g. 3 kA. The bridge provides for lead balancing, which can be carried out without interrupting the main circuit. C.F.Pizzey

621.317.733

7503 THE ASYMMETRIC BRIDGE. A.B.Kaufman.

Instrum. Control Syst., Vol. 33, No. 4, 634-5 (April, 1960).

The type of bridge discussed is the asymmetric half-bridge energized by two power sources and operated unbalanced. The power supplies must have zero internal impedances, and can be furnished by a closely regulated magnetic-amplifier-type supply. Compared with a symmetric Wheatstone bridge (i.e. with all arms equal), the asymmetric half-bridge can give a nearly fourfold increase of power to the indicating instrument for the same power dissipated in the sensitive arm (e.g. resistance thermometer or strain gauge); also, the asymmetric half-bridge gives a more linear output, particularly with large asymmetry factors. The asymmetry factor (K) is the value of the sensitive arm divided into that of the arm in series with it. A factor K of 20 approximates the knee of the power–voltage gain curve. C.F.Pizzey

621.317.733

7504 A SIMPLE GRAPHICAL METHOD FOR SOLVING SOME PROBLEMS IN CONNECTION WITH A.C. BRIDGE NETWORKS. S.K.Basu.

J. Assoc. Appl. Physicists, Vol. 5, 63-73 (1958).

Presents a simple graphical technique for determining (i) the magnitude and phase angle of the out-of-balance voltage across the detector terminals; (ii) the locus of the detector voltage as balance is gradually approached from an originally unbalanced condition; and (iii) the change of impedance necessary in the adjustable bridge-arm to obtain balance (determinable from the construction of the balancing locus).

621.317.733

7505 TECHNICAL CONSIDERATIONS FOR AN ULTRA-SENSITIVE BRIDGE TO MEASURE R.F. POWER AND VOLTAGE. L.J.Greenstein, R.B.Schulz, M.Epstein and D.Fryberger.

Proc. Nat. Electronics Conf., Vol. 15, 898-908 (1959).

Presents basic considerations in the design of a d.c. operated, temperature compensated, balanced thermistor bridge which is used in the measurement of low level r.f. power and voltage. The bridge is maintained at balance in the presence of r.f. power by removing from the thermistor an equal and easily measured amount of d.c. power. The r.f. and d.c. calibrating signals are applied simultaneously in pulses in order to diminish the effect of d.c. drift in the bridge output. The relationship between these signals is derived and sources of error are discussed. The thermistor response to pulsed energy is analysed on the basis of thermal equilibrium considerations. An approximate analysis of the thermistor bridge can be made by assuming linearity of the thermistor voltage–current characteristics over the range of operation. On the basis of this assumption, useful predictions can be made concerning the influence of circuit components on bridge sensitivity, bridge stability, balancing resolution, and accuracy. The linear expression for the thermistor characteristics is obtained empirically and its application to analysis is shown. Theoretical predictions are compared with experimental results, and the choice of components for optimum bridge performance is discussed.

621.317.733 : 536.33

7506 IMPROVED BRIDGE FOR LOW TEMPERATURE MEASUREMENTS. W.L.Briscoe.

Rev. sci. Instrum., Vol. 31, No. 9, 999-1000 (Sept., 1960).

Describes an improved resistance thermometer, a low temperature measuring bridge with self-indication of bridge zero. The phase of the oscillator output is inverted and these polarities are applied to the suppressor grids of two phase-comparator valves. The circuit is adjusted so that the amplified bridge signal is in phase with different valves on different sides of zero, the indicating meter being placed between the anodes of the two valves. Some additional improvements are also mentioned. V.Bradić

621.317.733 : 537.3

7507 INEXPENSIVE HIGH RESOLUTION WHEATSTONE BRIDGE. K.Klund.

Rev. sci. Instrum., Vol. 31, No. 9, 1004 (Sept., 1960).

A modified circuit of the Wheatstone bridge by which extremely small changes of resistance can be measured. V.Bradić

621.317.733 : 621.395.722

7508 CABLE MEASURING BRIDGE FOR TRUNK EXCHANGES. R.Kallen.

Tech. Mitt. P.T.T., Vol. 38, No. 4, 118-21 (1960). In German and French.

All Swiss trunk exchanges are now provided with desk-mounted bridges which are designed for both routine and precision measurements on cables. The bridge described in general terms can serve for the following measurements: (a) resistance (0.01 ohm - 1 Megohm); (b) Varley, Murray, Graf, insulation (1-20 000 Megohm). A spot galvanometer is used as detector and a very rigorous RC

filter is included in the 200 V supply circuit to prevent oscillations of the light spot. The bridge is fully supplied from the mains. The diagram of the bridge is not given. J.M.Silberstein

621.317.733

7509 CALCULATION OF THE OUTPUT LEVEL OF BRIDGES. H.Hognestad.

Elektrotek. T., Vol. 73, No. 22, 367-71 (Sept. 5, 1960). In Norwegian.

For efficient bridge design it is necessary to know the output level for a given change in the physical quantity to be measured. The method given illustrates the interaction between the various arms and shows how the bridge may be designed for maximum sensitivity. The formulae developed assume only one arm to be active, i.e. if its resistance varies, the bridge becomes unbalanced; the formulae can, however, easily be extended to cover several active arms. The output voltage of the bridge U_x is connected with the input voltage U by the relation $U_x = U.\delta.\alpha$ where x is a parameter which must be a maximum for maximum sensitivity. Sets of curves are plotted showing α as a function of m where $m = R_2/R_1$, the ratio of two arms. The use of the curves is explained in a numerical example. The properties of a bridge fed by a constant-current source are also discussed. G.N.J.Beck

621.317.74

7510 A TEST SET FOR MEASUREMENT OF ENVELOPE DELAY DISTORTION AT AUDIO FREQUENCIES WITH 1-MICROSECOND PRECISION. W.A.Codd.

Trans Amer. Inst. Elect. Engrs I, Vol. 79, 241-5 (1960) = Commun. and Electronics, No. 49 (July, 1960).

A test set is described which enables direct measurement of envelope delay distortion, at audio frequencies, with a precision of 1 μsec. This result is obtained by generating a test signal composed of a pair of frequencies which can be swept through the audio range with a constant difference of $33\frac{1}{3}$ c/s and observing the difference in phase shift of the two frequencies incurred by the insertion of the test network. This procedure enables the phasemeter to be used at a constant frequency ($33\frac{1}{3}$ c/s) thus obviating the necessity for continuous rebalancing during point-by-point single frequency measurements. H.L.Nattrass

621.317.741

7511 A MULTIPLE ISOLATED-INPUT NETWORK WITH COMMON OUTPUT. C.M.Allred and C.C.Cook.

J. Res. Nat. Bur. Stand., Vol. 64C, No. 3, 225-8 (July-Sept., 1960).

A circuit is described having n inputs which are isolated from each other but fed into a common output. Theoretically, the circuit presents matched impedances at each of the inputs and the output and has minimum transmission loss. Design equations are presented for the general case and performance data is given for a two-input and a three-input unit.

621.317.753

7512 LIGHT BEAM OSCILLOGRAPHS FOR RECORDING ELECTRICAL AND NON-ELECTRICAL QUANTITIES. W.Kaiser.

Elektronik, Vol. 9, No. 7, 193-8 (July, 1960). In German.

The construction and characteristics of the oscillating coil are discussed, and data of several multi-channel instruments are given. W.G.Stripp

621.317.755 : 621.374.3 : 539.1.07

7513 THE PULSE SAMPLING OSCILLOSCOPE. P.R.Orman.

Nuclear Electronics Conference, Paris, 1958. Vol. I.(see Abstr. 4975 of 1960), 209-16.

The waveform to be displayed is sampled by pulses of 10^{-9} sec width. At each sampling, the mixer produces a 50 μsec pulse having an amplitude proportional to that of the test wave-form over the sampling period. These pulses are applied to the Y plates of the c.r.t. Brightness modulation is applied so that only the tops of the pulses are visible, tracing out the shape of the test pulse on a magnified time scale. The bandwidth obtained is 300 Mc/s. W.G.Stripp

621.317.755

7514 CONVERTING OSCILLOSCOPES FOR FAST RISE TIME SAMPLING. J.J.Amodei.

Electronics, Vol. 33, No. 26, 98-9 (June 24, 1960).

An oscilloscope attachment is described which uses sampling techniques to effectively stretch the time scale of a signal. Samples of the instantaneous signal amplitude at different times are taken, and the original shape is reconstructed by peak-detecting the amplified and stretched samples. It is thus possible to display very short rise-time pulses on a conventional oscilloscope, with consequent high sensitivity and relative simplicity. The attachment is completely transistorized, and includes its own power unit. The circuit, which follows lines suggested in Abstr. 4672 (1958) and 3490 (1959) is discussed in detail, and waveforms and component values are given. Pulse rise-times of $\frac{1}{3}$ ns can be resolved with repetition rates up to 50 kc/s, and it is claimed that faster units with 3 dB bandwidths up to 2 Gc/s have been constructed. D.J.Bailey

621.317.755 : 621.317.333.8

7515 IMPULSE TESTING WITH A STORAGE TUBE. E.L.White.

Engineering (London), Vol. 189, 706-7 (May 20, 1960).

The display-storage c.r.t. can store and display information, the brightness and duration of the display being largely independent of the storage time. For example, an oscillogram lasting a few microseconds can be observed in normal room lighting for more than 30 sec. The principles of the tube are explained and with reference to its use in impulse testing, where its greatest advantage is in saving time previously spent in photographic processing. Its main limitations at the present stage of development are lack of definition and rather low writing speed. However, photographic records showing wavefronts of up to 280 kV with timing oscillations of up to 2.5 Mc/s are reproduced. A record of a 10 Mc/s oscillation, displayed and photographed in normal room lighting, is also shown. D.J.Bailey

621.317.755 : 621.385

7516 NOTES ON THE CONSTRUCTION OF A CHARACTERISTIC PLOTTER FOR ELECTRON TUBES. G.Heydt.

Elektronik, Vol. 9, No. 7, 201-3 (July, 1960). In German.

In the instrument described, the anode of the valve is fed with a full-wave rectified 50 c/s supply. A staircase waveform, derived from and synchronized with the mains voltage, is applied to the grid, so that as the anode voltage rises to max, or falls to zero, the grid potential is constant at one of 8 values. The usual c.r.t. display is used. W.G.Stripp

621.317.755

7517 FRACTIONAL MILLIMICROSECOND ELECTRICAL STROBOSCOPE. W.M.Goodall and A.F.Dietrich.

Proc. Inst. Radio Engrs, Vol. 48, No. 9, 1591-4 (Sept., 1960).

A simple electrical stroboscope having a rise time of 6×10^{-11} sec and a 6 dB bandwidth of 5.5 Gc/s is described. Oscillograms showing 160 Mc/s square waves and 64×10^7 pulses per sec are shown. Instrumentation includes a strobe-pulse generator, a coaxial gate using a gallium-arsenide point-contact crystal, suitable wideband coaxial attenuators, a low-pass integrating filter and a low-frequency oscilloscope.

621.317.755

7518 THE RECORDING OF HIGH-SPEED SINGLE-SHOT PHENOMENA. F.E.Whiteway.

Proc. Instn Elect. Engrs, Paper 3294 E, publ. Nov., 1960 (Vol. 107 B, 615-23).

Techniques at present in use for the recording of single-shot phenomena by cathode-ray oscillographs are reviewed. Cathode-ray tubes are discussed, with particular attention to the conflicting requirements of high writing speed, wide bandwidth and high sensitivity. These requirements can be met to a large extent by the use of very small spot size and travelling-wave techniques. An account is given also of associated circuits including high-speed time-bases, amplifiers and calibration equipment.

321.317.757

7519 A SURVEY OF WAVE ANALYSERS AND DISTORTION-FACTOR METERS. R.Brown.

Brit. Commun. and Electronics, Vol. 7, No. 10, 760-5 (Oct., 1960).

621.317.757

7520 AN IMPROVED TRANSISTORIZED WAVE ANALYZER. J.R.Petrak.

Proc. Nat. Electronics Conf., Vol. 15, 874-83 (1959).

The problem of introducing an automatic frequency-control system into a wave analyser and how it was solved through the use of semiconductor circuitry is discussed. Other problems encountered and their solutions were those of developing a stable oscillator utilizing transistors, a low distortion amplifier, a selective crystal filter and a modulator of low harmonic distortion content.

621.317.757

7521 NEW LOOK AT WAVE ANALYZER DESIGN. J.R.Petrak.
Electronics, Vol. 33, No. 39, 68-70 (Sept. 23, 1960).

Describes a transistorized harmonic analyser having an input signal frequency range of 0-50 kc/s. Frequency selection on a linearly calibrated dial, high input impedance, great temperature stability and small size and weight are claimed as special features. T.R.Foord

621.317.77

7522 PHASE ANGLE MASTER STANDARD FOR 400 CYCLES PER SECOND. J.H.Park and H.N.Cones.
J. Res. Nat. Bur. Stand., Vol. 64C, No. 3, 229-40 (July-Sept., 1960).

A continuously variable, 0- to 180°, phase-shift standard for 400 c/s is described in detail. It consists of a π-section line made up of twelve 14.6° and three 4.3° sections to provide for two sizes of coarse steps and an RC ciruit at the input to the line to provide for fine steps and a continuous fine control. A method for accurately adjusting the characteristic impedance of all π-sections to the same value, which is used as the termination, was devised. Under these conditons it is shown that the phase-shift introduced by each π-section can be accurately computed from a measured value of inductance. The phase-shift of each π-section was also determined by an experimental procedure dependent upon a 180° phase-shift introduced by a toroidal transformer. The values obtained by these two independent methods agree to within 0.01°.

621.317.785

7523 METHOD FOR DETERMINING THE DRIVING TORQUE OF SOME INDUCTION APPARATUS. M.P.Zlatev.
C.R. Acad. Bulg. Sci., Vol. 13, No. 1, 39-42 (Jan.-Feb., 1960). In French.

The apparatus considered is the a.c. induction watt-hour meter. An approximate method is given for calculating the torque which is based on geometric parameters of the elements, the two fluxes and a conductance figure for the disk. C.F.Pizzey

621.317.785

7524 ELECTRONIC SUMMATION METERING. A.C.Robb.
Elect. Rev., Vol. 167, No. 3, 95-101 (July 15, 1960).

Considers the advantages of applying electronic techniques to summation metering, and a transistorized system is discussed which eliminates coincidence errors by sequentially scanning bistable stores in each summator input line. A photo-electric impulsing device is described which imposes negligible mechanical loading on transmitting meters at high pulse rates. An impulsing motor is also described, suitable for driving duplicate totalizer registers, and maximum-demand indicators. The system does not involve impulsing contacts.

621.317.785

7525 THE BEHAVIOUR OF WATTHOUR METERS WITH LOAD SURGES IN ALTERNATING DIRECTIONS OF ENERGY FLOW. S.Franck.
Elektrizitätswirtschaft, Vol. 59, No. 11, 358-60 (June 5, 1960). In German.

Provided the direction of energy flow remains unchanged, load surges have only a negligible effect upon the accuracy of a watthour meter. Should the direction of energy flow alternate, an accurate result is still obtained provided the meter is used to measure the algebraic sum of the energy delivered and received. If the meter is adapted by fitting a return stop to measure the energy transmitted in one direction only, the error can be considerable. This error may be nullified by disconnecting the voltage circuit of the meter at the instant of current reversal instead of using a return stop. As the error depends upon the ratio between the returned energy and the delivered energy, there is no need in many cases to effect this correction. A.S.Hay

621.317.785

7526 APPARATUS FOR RECORDING AND PLAYBACK OF CURVES. W.Krannich.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 13, 315-17 (June 27, 1960). In German.

A portable recording instrument is described where the voltage applied to the stylus burns out a track on a sheet of metallized paper wrapped around a drum. The stylus is operated by an automatic null potentiometer which can be made to read voltage, current or power. The curve can be played back repeatedly by applying low voltage of opposite polarities to the two sides of the track and reconnecting the stylus in a servo system to follow it. The instrument is intended for taking records of load curves on consumers' premises. See also following abstract. Z.A.A.Krajewski

621.317.785

7527 A NEW METHOD OF OBTAINING DAILY LOAD CURVES. H.Laakmann.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 13, 317-19 (June 27, 1960). In German.

The recording instrument of Krannich (see preceding abstract) requires a special adaptor for plotting curves of power consumption when the mains voltage or power factor are not constant. This adaption is described. A photoelectric system counts the revolutions of a watt-hour meter over a four-minute period. The counts are transmitted to a step-motor which sets the wiper of a precision potentiometer. At the end of every four minutes the potentiometer reading is switched over to the recording instrument which thus traces a stepped power curve. Illustrations are given of some construction details. Z.A.A.Krajewski

621.317.79 : 621.385.832

7528 C.R.T. PHOTOMICROMETER. A.Cuiciura.
Mullard tech., Commun., Vol. 5, 141-58 (June, 1960).

The photomicrometer provides on a pen-recorder chart a light-intensity profile of a line on a c.r.t. raster. A complete description of the instrument is given, and various theoretical considerations are covered. The applications and limitations of the photomicrometer in respect of measurements of line width, resolution and astigmatism are also discussed.

621.317.79

7529 DIRECT READING NOISE FIGURE MEASURING DEVICE. G.Bruck.
Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1342 (July, 1960).

Noise from a standard source is controlled by a multivibrator and injected into the system under test. The output is gated into a balanced thermistor bridge. Unbalance of the bridge is fed back to control the mark–space ratio of the multivibrator. The device is calibrated when the standard noise power, the mark–space ratio and the thermal noise of the system are known. C.Fromberg

621.317.79

7530 DESIGN AND PERFORMANCE CHARACTERISTICS OF A HIGH-SPEED WIDE-CHART RECORDER. J.C.Garrigus.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 163-70 (1960) = Commun. and Electronics, No. 48 (May, 1960).

The recorder is of the null-balance, potentiometric type, and consists of a potentiometer circuit, a d.c.-a.c. chopper-type convertor, input transformer, valve amplifier, 2-ph. servomotor, a.c. tachometer and feedback network, and recording mechanism. The potentiometer circuit is of the so-called "divider" type. A capacitor (1 μF) is connected across the slide-wire contacts and maintains the slide-wire voltage if the circuit momentarily opens as a result of contact bounce. The amplifier consists of four RC-coupled stages and a power output stage, the overall voltage gain being $\sim 100 \times 10^6$. The output valve delivers 9 W to the control winding of the servomotor under stalled conditions. A parallel-T network and RG-filters suppress interference voltages at mains and second harmonic frequencies. The balancing system saturates when the deviation reaches 2%, and provides a max. torque of 24 oz.in. The dead zone is 0.1%. The response time for f.s.d. is 0.37 sec, of which 0.06 sec is required for acceleration and 0.06 sec for deceleration. Curves are given for the step response, ramp response and the frequency response of the instrument. G.F.Pizzey

621.317.79

7531 CONTINUOUS-LINE RECORDERS IN INDUSTRIAL MEASUREMENTS. G.Jentsch and F.Schubert.
Z. InstrumKde., Vol. 68, No. 3, 45-54 (March, 1960). In German.

A review of the constructional features and the performance of modern recorders, including potentiometric and other self-balancing types. The following are discussed: the relation between chart width, accuracy and readability; methods of marking the chart, including the use of metallized paper; pens, ink and paper; mechanical linkages and other methods giving straight-line ordinates; recorders requiring minimum panel space. The examples illustrated are all of German manufacture. C.F.Pizzey

621.317.79 : 621.316.91

7532 INSTRUMENTATION FOR EXPLODING WIRE RESEARCH. N.Chase, N.Hankin and F.Webb.
Electronics, Vol. 33, No. 27, 43-5 (July 1, 1960).

Gives general description of basic circuit for exploding wires of 0.001 in. diam. This includes a "Trigatron" switch with 7 ns turn-on time, Kerr cell camera with 5 ns exposure and travelling-wave oscilloscopes. Reproducible results allow a moving picture to be made showing the various stages in the explosion of thin wires in a time range of 50 ns. A.E.I. Research Laboratory

621.317.799

7533 TRANSISTORIZED SOUND LEVEL METER. W.V.Richings and B.J.White.
Electronics, Vol. 33, No. 25, 64-6 (July 17, 1960).

The instrument uses a crystal microphone, a high input-impedance stage comprising two emitter-followers in a bootstrap arrangement, gain-stabilized amplifiers and frequency weighting circuits. The range is from 24 to 140dB. W.G.Stripp

MAGNETIC DEVICES AND MATERIALS

621.318.1

7534 MAGNETIC MATERIALS. C.G.Smith.
Elect. Rev., Vol. 167, No. 7, 253-9 (Aug. 12, 1960).

After a brief introduction and general consideration of properties, descriptions are given of the more important materials in current use, e.g. nickel-iron alloys, magnetostrictive materials, permanent magnets, ferrites, and constant-permeability materials. This is followed by consideration of their use in various fields of application, including line communications, radio and television, instrumentation, automation and computation. Brief details of essential properties are given in tabular form.

621.318.1

7535 THEORETICAL HYSTERESIS LOOPS OF THIN MAGNETIC FILMS. H.J.Oguey.
Proc. Inst. Radio Engrs, Vol. 48, No. 6(1), 1165-6 (June, 1960).

Starting with three simplified hypotheses, determines the theoretical static behaviour of thin films assuming single domain structure and rotational processes only. A graphical method is used to plot magnetization curves which are in good agreement with experimental results. D.J.Truslove

621.318.12 : 538.1

7536 MAGNETIC LOSSES IN CORES OF VARIOUS SHAPES. D.S.Robertson and D.Elliott.
Nuclear Instrum. and Methods, Vol. 5, No. 3, 133-41 (Sept., 1959).

The shape of magnetic cores determines the distribution of flux within them, so that it is reasonable to expect magnetic losses to be a function of core shape. In this paper, hysteresis and eddy current losses are calculated for the following cases: rectangular cores; rectangular cores with air gaps; ring cores. The results show that a square core is only slightly inferior to an equivalent ring core. Although an air gap is shown to be of value in relieving the high concentrations of loss near the inside corners of the core, it is found to have little effect on the total loss. Similarly, the "rounding off" of inside corners is shown to be of limited value. The results of the analysis are checked experimentally.

621.318.122 : 539.2 : 538.2

7537 PROCEEDINGS OF THE FERROMAGNETISM WORKING PARTY 1959. [Berichte der Arbeitsgemeinschaft Ferromagnetismus 1959].
Düsseldorf: Verlag Stahleisen (1959) 270 pp. In German.

The meeting was held in Berlin, in October, 1959, under the auspices of the Deutsche Gesellschaft für Metallkunde, the Werkstoffausschuss of the Verein Deutscher Eisenhüttenleute and the Verband Deutscher Physikalischer Gesellschaften. The proceedings contains 36 articles. Abstracts of selected articles will be found in this or succeeding issues of "Electrical Engineering Abstracts".

621.318.124

7538 INFLUENCE OF TECHNOLOGICAL FACTORS ON MAGNETIC PARAMETERS OF BARIUM FERRITE. R.Sroczyński.
Arch. Elektrotech (Warsaw), Vol. 8, No. 3, 499-520 (1959). In Polish, with summary (1 p.) in English.

621.318.13

7539 PIEZOMAGNETIC FERRITES. (APPLICATIONS IN FILTERS AND ULTRASONICS). C.M.van der Burgt.
Electronic Technol, Vol. 37, No. 9, 330-41 (Sept., 1960).

The use of newly developed nickel copper cobalt ferrites and nickel cobalt ferrites for transducers and band-pass filters is discussed. The criteria for various applications are discussed, in particular the dependence on temperature of resonant frequency and coupling factor. Particular reference is made to transducers and the mechanism of ultrasonic cleaning. Band-pass and comb filters using ferrites as transducers and resonant elements are also described. Tables and graphs of piezomagnetic properties of alloys and ferrites are presented. A.C.P.Thiele

621.318.132

7540 DISCUSSION OF LINE WIDTH AND GYROMAGNETIC RATIO. I.Bady.
I.R.E. Trans Microwave Theory and Tech. Vol. MTT-8, No. 3, 376-7 (May, 1960).

Summarizes some of the significant results of work on the measurement and interpretation of line width and gyromagnetic ratio of microwave ferrite materials. R.C.Glass

621.318.2

7541 THE EFFECT OF TEMPERATURES OF 650°C AND 700°C ON THE MAGNETIZATION AND PROPERTIES OF ALCOMAX MAGNETS. A.G.Clegg and M.McCaig.
Rep. Brit. Elect. Res. Assoc., Rep N/T86, 4 pp. (1960).

In the work described, the effect of maintaining Alcomax III magnets at temperatures of 650° and 700°C for times varying from 5 minutes to 21 hours was investigated. Although magnets exposed to these temperatures are not stable, they may still be used for holding and similar purposes provided some deterioration in performance can be tolerated.

621.318.3 : 621-52 : 681.142

7542 A LIST OF THE [RUSSIAN] LITERATURE OF 1958 ON MAGNETIC ELEMENTS FOR AUTOMATION, REMOTE CONTROL AND COMPUTING TECHNOLOGY.
Avtomat. i Telemekh., Vol. 20, No. 9, 1302-10 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No.9, 1260-79 (Sept., 1959; publ. May, 1960).

621.318.3

7543 AN ANALYTICAL METHOD OF CALCULATION OF THE DYNAMICS OF D.C. ELECTROMAGNETS. A.K.Ter-Akopov.
Elektrichestvo, 1960, No. 5, 1-5 (May). In Russian.

The problem is reduced to a set of two differential equations in terms of the instantaneous values of flux Φ and the traversed path x both of which are nonlinear functions of time t. An approximate solution is sought by expanding Φ and x in power series. It is shown that the t^3 term is the predominant one in the $x = f(t)$ series, and the remaining terms can be neglected with reasonable accuracy. A general formula for the time of motion of the armature is hence derived. The effect of various design parameters is examined showing that there is an optimum inductance and an optimum opposing force to give the fastest operation. Experimental figures deviate by 15-18% from calculation on account of the assumed approximations. 8 refs. Z.A.A.Krajewski

621.318.3

7544 OPTIMUM CORE INDUCTIONS FOR ALTERNATING CURRENT SHUNT MAGNETS. E.Naidenow.
Elektrie, Vol. 14, No. 7, 266-8 (July, 1960). In German.

The optimum core induction is obtained when the ratio between the square of the flux and the sum of the core and coil volumes is a maximum. This principle is used to determine the optimum induction for soft-iron and Armco steel cores. A.S.Hay

621.318.3 : 621.384.612 : 538.1 : 537.54

7545 THE TESTING OF THE ELECTRO-MAGNET SEGMENTS OF THE SACLAY SYNCHROTRON.
G.Bronca, H.Bruck, J.Hamelin, G.Neyret and T.Bolzinger.

Nuclear Instrum., Vol. 1, No. 3, 123-32 (May, 1957). In French.

After a brief description of the synchrotron magnet and the effects of the field inhomogeneities the principle of the stacking procedure to minimize these effects is described. A practical way of determining the azimuthal location of the blocks is developed. Finally an estimate is made of the gain of the operation with respect to a random distribution of the segments.

621.318.3

7546 SINTERED MATERIAL FOR MAGNETS. F.Núñez.

Rev. Cienc. apl., Vol. 14, No. 2, 97-106 (March-April, 1960). In Spanish.

Describes experiments in the production of a range of hard magnetic materials of the approximate composition $Fe_{12}O_{19}Ba$, and presents curves of: coercive force against grain size and density, $(BH)_{max}$ against equivalent BaO content, B against H and derived parameters. Some data on stability and a brief discussion of some applications are included. F.F.Roberts

621.318.3

7547 A METHOD FOR THE DESIGN OF HOLDING ELECTRO-MAGNETS. J.T.Ludwig.

Trans Amer. Inst. Elect. Engrs I, Vol. 79, 300-10 (1960) = Commun. and Electronics, No. 49 (July, 1960).

Refers to the design of magnets for holding a switch or contact assembly. The basic theory is outlined and charts are prepared to assist in the choice of mechanical design. V.G.Welsby

621.318.3 : 621.316.721 : 538.56

A PARTICULARLY SIMPLE CURRENT STABILIZER OF THE HIGHEST GRADE FOR ELECTROMAGNETS. See Abstr. 7327

621.318.3 : 621.316.721

A SCANNING MAGNET-CURRENT REGULATOR FOR MAGNETIC RESONANCE. See Abstr. 7329

621.318.34 : 537.54

7548 FIELD STABILIZATION IN A D.C.–A.C. EXCITED MAGNET OF A SYNCHROTRON. G.Ghigo and I.F.Quercia.

Nuclear Instrum., Vol. 1, No. 2, 57-61 (March, 1957).

The shape of the magnetic field of an electron synchrotron is quite critical at injection. If the machine is fed with an a.c. current and with a bias d.c. current, the shape of the field at injection is quite sensitive to the values of the peak a.c. current and of the d.c. current. A device is described that is sensitive to the difference between peak a.c. and d.c. current and which keeps this difference constant by controlling the value of the d.c. current. The apparatus was applied to model magnets of the 1 GeV Italian electron-synchrotron and is planned for controlling the supply of the synchrotron.

621.318.381

7549 DESIGN OF AN EDDY-CURRENT BRAKE FOR A SODIUM-COOLED NUCLEAR POWER REACTOR. R.S.Baker.

Trans Amer. Inst. Elect. Engrs I, Vol. 79, 330-3 (1960) = Commun. and Electronics, No. 49 (July, 1960).

621.318.381 : 539.2 : 537.3 : 538.1

7550 THE PRODUCTION OF HIGH, PULSED MAGNETIC FIELDS. P.Cotti.

Z. angew Math. Phys., Vol. 11, No. 1, 17-32 (Jan. 25, 1960). In German.

The design of an apparatus using capacitor discharges is discussed. Efficiency, heating and strength are investigated. The calculations are compared with experimental data on coil types producing 320 000 A/cm (400 000 Oe) for 1 ms in a volume of 0.5 cm^3 and 80 000 A/cm (100 000 Oe) for 100 ms in 10 cm^3. Results of magnetoresistance measurements on copper to 260 000 A/cm (325 000 Oe) at liquid nitrogen temperature and to 160 000 A/cm (200 000 Oe) at liquid helium temperature are given. In a Kohler diagram these results are in agreement with work by Chambers [Abstr. 6195A of 1957, Proc. Roy. Soc. A, Vol. 238, 344-57 (Jan. 8, 1957)] on purer specimens in lower fields.

INDUCTORS . REACTORS RELAYS

621.318.4

7551 SELF INDUCTANCE OF A THICK CIRCULAR CYLINDRICAL BOBBIN WITH A VERY LARGE NUMBER OF LAYERS EACH CONSISTING OF A VERY LARGE NUMBER OF TURNS OF FINE WIRE. R.Cazenave.

Ann. Telecomm., Vol. 15, No. 7-8, 150-6 (July-Aug., 1960). In French.

Formulae are derived for calculating the inductance of multi-layer windings, neglecting the effects of distributed capacitance. Expressions are first obtained for the inductance of a single layer and the total obtained by integration. V.G.Welsby

621.318.43 : 621.335

7552 DESIGN AND CALCULATION OF SMOOTHING REACTORS FOR RECTIFIER LOCOMOTIVES. W.Holfert and W.Wendt.

Elektrie, Vol. 14, No. 6, 206-10 (June, 1960). In German.

Formulae are obtained for the number of turns and optimum air gap with no attention to leakage flux. The conditions of minimum expenditure of material are analysed. In an example the characteristic data of a reactor and the leakage inductance are calculated. P.Szekely

621.318.435.3

7553 SYSTEMS USING TRANSISTORS AND TRANSDUCTORS. I-II. D.A.Ramsay.

Electronic Engng, Vol. 32, 476-9 (Aug.), 540-4 (Sept., 1960).

A general discussion of behaviour of transductor cores and principal applications of their properties, followed by description of operation of a Ramey amplifier [Abstr. 2824 and 3312 (1952)]. In a two-winding amplifier the input can be conveniently controlled by a transistor. A design method for such combination is given, together with description of transductor-stabilized, small size, d.c. power packs based on this idea. Ripple reducers are included. Outputs range from −10 V, 200 mA to −780 V, 2.5 mA. Efficiencies are about 50%. A.K.Podkolinski

621.318.435.3

7554 CROSSED-FIELD MAGNETIC TRANSDUCTORS AND THEIR PARTICULAR APPLICATIONS. M.Perez de Vera and S.Rizzo.

Elettrotecnica, Vol. 47, No. 3, 172-8 (March 10, 1960). In Italian.

It is first pointed out that if a direct and an alternating field are mixed in a core by means of windings which do not couple with one another, certain advantages will accrue. An experiment is described in which a simple toroid of circular laminations provided with an a.c. winding is fitted near the centre of a long solenoid fed with direct current. By this means, the B–H characteristics of the core can be examined for various values of polarization. From a number of oscillograms taken at various terminal voltages and load resistances, it becomes apparent that the effect of the d.c. controlling field is to alter the slope of the major axis of a narrow B–H loop. A curve showing the relation between the transverse component of maximum induction and the direct exciting current shows a useful linear region. It is thus possible to control the alternating current in the load over quite wide limits, while maintaining a sinusoidal waveform. Two applications which are suggested are the measurement of direct voltage and the use of a similar arrangement as a distortionless variable attenuator. In an improved construction of the device, the transverse field is provided by a ring winding held between two halves of a toroid core. S.C.Dunn

621.318.435.3

7555 TRANSDUCTORS: THE DEPENDENCE OF THEIR CHARACTERISTICS UPON CIRCUIT CONNECTIONS AND CORE DESIGN. H.Mann Sørensen.

Ingeniøren, Vol. 69, 482-6 (Aug. 15, 1960). In Danish.

A survey of special circuit connections with particular reference to the Ramey circuit. The effect of core design on amplification and time constant is studied. A distinction is made between non-self-magnetized and self-magnetized transductors. The Ramey circuit is one of the latter; in it the control is adjusted so that there is a strong negative voltage feedback. It offers the advantage of electrical separation between the control and main circuits. Possibilities are discussed of controlling transductors during one half-period, this being the most rapid control possible. G.N.J.Beck

621.316.435.3

7556 DESIGN OF TRANSDUCTORS. J.K.Choudhury and S.K.Ghose.
J. sci. industr. Res., Vol. 18A, No. 9, 413-21 (Sept., 1959).

Describes the design and performance of transductors and their application in electrical instrumentation practice, viz. (1) a conventional magnetic amplifier having an output of about 0.5 W for operating a recording instrument; (2) a pair of transductors used as a current transformer for d.c., (3) a second-harmonic type magnetic inverter, and (4) a typical transductor control relay.

621.318.5 : 621.374.32

7557 ANALYSIS OF RELAY CIRCUITS WITH THE AID OF A MACHINE. P.P.Parkhomenko.
Avtomat. i Telemekh., Vol. 20, No. 4, 486-97 (1960). In Russian.

A machine capable of analysing relay circuits containing up to 20 relays is described. It contains 180 relays, 6 uniselectors, 500 three-position switches, 120 signal lamps, a plugboard with patch cord connectors and an automatic printer of output results. The dimensions of the machine are 1800 × 1200 × 350 mm. Parallel and sequential operation of relay circuits can be analysed. Some circuits have to be converted to equivalent ones on the basis of Boolean logic. The machine checks the circuits, discovers errors or malfunctions and helps in designing economic circuits with the minimum of elements. 11 references in Russian and English.
A.Woroncow

621.318.5

7558 DETERMINATION OF THE VAPOUR PRESSURE OF PLASTICIZERS AND INSULATION OF PLASTICIZER VAPOURS IN AIR. H.Mauch.
Tech. Mitt. P.T.T., Vol. 38, No. 4, 143-8 (1960). In German.

Contacts on relays can become faulty under the influence of organic vapours in air, principally the vapours of plasticizers from nearby dielectrics. The determination of the vapour pressure of some plasticizers in order to produce data necessary for finding the concentration of harmful vapours particularly in automatic telephone exchanges is described. Two methods are given, one graphic and the other gravimetric.
W.A.Walker

621.318.5.066.6

7559 IDENTIFICATION OF CONTACT CONTAMINATIONS BY ELECTRON OPTICAL METHODS.
H.Pfisterer and E.Fuchs.
Siemens-Z, Vol. 34, No. 8, 484-8 (Aug., 1960). In German.

The surface contaminations which form in the course of time on electrical contacts are discussed, and also the methods used for identifying them. A new method, using electron microscopy, is described in detail, with many illustrations.
P.M.Davidson

621.318.56

7560 DETERMINATION OF THE BASIC PARAMETERS OF ELECTROMAGNETIC RELAYS. M.I.Vitenberg.
Avtomat. i Telemekh., Vol. 20, No. 5, 637-47 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 5, 610-20 (May, 1959: publ. Feb., 1960).

The most important relationships between nominal work, consumed power, overheating temperature, dimensions and weights of electromagnetic relays are considered. Experimental curves are appended and empirical formulae are deduced for determining the operating conditions of a relay in terms of core cross-section, power consumed, overheating temperature and weight.

621.318.56

7561 DOUBLE COIL RELAY WITH ONE WORKING GAP. J.C.Schuessler.
Electronic Industr., Vol. 19, No. 5, 79-82 (May, 1960).

Normal advantages of double coil design using double-gap-armature magnetic characteristic are improved by restricting magnetic flux to a single operating gap. This is done by extending one pole face to provide a large central armature hinge mating area so that the flux takes this path of least reluctance. The design characteristics are evaluated in general terms and include a permanent magnet latch feature which entails minimum change of components.
R.W.J.Cockram

621.318.56

7562 PRODUCTION LINE CHECKER FOR RELAY CONTACT CHATTER. E.H.Kopp.
Electronics, Vol. 33, No. 21, 94-5 (May 20, 1960).

A circuit is described which will respond during the period of the test for chatter, if the contacts remain open (or closed) for longer than an acceptable period of time. The circuit responds to the first "occasion" only and gives no indication of the number of times the contacts may have opened, during the tests.
E.G.Knowles

621.318.56.066.6

7563 SYMMETRICAL AND UNSYMMETRICAL SILVERED HIGH CURRENT CONTACT POINTS. A.Wollenek.
Elektrotech.Z.(E.T.Z.) A, Vol. 80, No. 23, 826-7 (Dec. 1, 1959). In German.

It was shown in previous papers [Elektrotech. Z.(E.T.Z.) A, Vol. 80, No. 5, 139-42 (1959)] that the resistance of high current contacts depends very much on the nature of the surfaces, and that the effect of silvering is considerable. The effects of varying the arrangement of the contacts, and the thickness of silvering, are studied.
P.M.Davidson

ELECTROSTATICS . CAPACITORS

621.319.1

7564 NONLINEAR CAPACITORS BASED ON TRIPLE FERRO-ELECTRIC SYSTEMS. M.M.Nekrasov.
Elektrichestvo, 1960, No. 5, 76-9 (May). In Russian.

Available ferro-electric nonlinear capacitors are little used because of their high losses and temperature instability. Compared with the usual materials triple ferro-electric systems such as Ba (Ti, Sn, Zr)O_3 have higher permittivity and controlled change of capacitance and lower dielectric loss. The properties required may be modified by appropriate formulation of the material. The capacitance of a nonlinear capacitor in an a.c. circuit may be controlled by application of d.c. voltages, graphs of this effect for triple ferro-electrics are given. They are much better than the usual materials. The maximum dielectric loss occurs at the relatively low temperature of about 75°C and so the materials rapidly stabilize; however, in the temperature range of −20 to +70°C high voltage gradients should be used. Practical applications of nonlinear capacitors based on triple ferro-electrics are briefly described.
W.R.Stoker

621.319.339

7565 ENERGY STABILIZATION OF A 4-MeV ELECTROSTATIC ACCELERATOR USING CONTROLLED CORONA DISCHARGE. E.C.Fellows.
J. Brit. Instn Radio Engrs, Vol 20, No. 9, 685-94 (Sept., 1960).

Beam energy is stabilized by detecting beam displacements, due to potential changes at the high voltage terminal, on a horizontal slit situated at the exit of the electrostatic analyser. Differential currents, due to off-centring of the ion beam on this slit, are amplified and used to control the magnitude of corona discharge loading via the corona triode. Thus beam movements alter the loading on the generator and so regulate its output voltage. This system controls the energy of the particles emerging from the exit of the electrostatic analyser to an accuracy of one part in 10^3 over long periods.

621.319.339 : 537.2

7566 FUNCTION OF THE COLLECTING ELECTRODE IN A VAN DE GRAAFF GENERATOR. K.S.Subudhi.
Nuclear Instrum., Vol. 3, No. 6, 341-3 (Dec., 1958).

In the Van de Graaff electrostatic generator the electric charge at a high voltage is stored on a metallic collecting electrode. In 1933 Van de Graaff et al. stated that the spherical collecting electrode is similar to a Faraday's ice-pail. A new explanation of the generation of the high voltage in the above generator was presented in 1954 by Simon. It is based on a different fundamental principle, namely, the Volta's condensing electroscope principle. Simon concluded that if the spraying system is maintained at a constant potential, the collecting electrode will also attain a constant potential, the magnitude of which will be proportional to that of the spraying system. The factor of proportionality does not depend on the capacity of the collecting electrode but depends on the height of the machine. The results of the experiments performed on a self-exciting generator of Becker type indicate that the voltage of the generator does not depend on the metallic sphere and the voltage is increased as the height is increased even though the same collecting system is used. This is qualitatively in accordance with Simon's theory.

621.319.339 : 537.54

7567 A VAN DE GRAAFF ACCELERATOR TUBE OF VERY LOW RETROGRADE ELECTRON CURRENT.

D.R Chick, S.E.Hunt, W.M.Jones and D.P.R.Petrie.
Nuclear Instrum. and Methods, Vol. 5, No. 4, 205-10 (Oct., 1959).

The upper limit to the voltage attained by Van de Graaff accelerators is often set by the flow of electrons towards the positive terminal of the tube, producing large X-ray fluxes and ionization currents in the gas between the high voltage terminal and the earthed pressure vessel. By designing the internal electrodes of the tube to trap retrograde electrons a voltage of 3.7 MV has been obtained across a nine foot long tube, with immeasurably small electron currents. The performance of this tube is compared with that of tubes employing other internal electrode designs.

621.319.339 : 621.382 : 537.54

7568 THE ELECTRON VAN DE GRAAFF IN SEMICONDUCTOR RESEARCH. W.L.Brown.

Nuclear Instrum. and Methods, Vol. 5, No. 4, 234-41 (Oct., 1959).

A 1 MeV electron Van de Graaff accelerator has been applied to fundamental semiconductor research. Its versatility as a pulsed source of ionization for studying electrical transients in these materials and under d.c. operation for introducing atomic defects into solid lattices has been exploited. These two aspects of the accelerator are discussed with examples from experiments in germanium.

621.319.339 : 537.54

7569 THE USE OF ELECTROSTATIC GENERATORS AS INJECTORS FOR ELECTRON SYNCHROTRONS.

D.Luckey.
Nuclear Instrum. and Methods, Vol. 5, No. 4, 266-8 (Oct., 1959).

Some experiences with the use of electrostatic generators as injectors for electron synchrotrons at Cornell University and M.I.T. are described. At M.I.T. the injection energy was changed without any other essential modifications to the synchrotron. A factor of ten in intensity has been obtained, along with greater stability. Space charge does not appear to be the limiting mechanism of the beam current.

621.319.4

7570 THE THERMAL STRESSES ARISING IN THE SOLID DIELECTRIC OF CYLINDRICAL POWER CAPACITORS.

K.W.Rudy.
Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 12, 428-30 (June 6, 1960). In German.

The temperature distribution in a cylindrical capacitor, in which heat is generated at a constant rate, is calculated for cooling on either the outer or the inner surface. The stress field due to thermal expansion is then derived and the maximum value determined. Taking a ceramic capacitor operating at radio frequency as an example, the maximum permissible voltage to avoid cracking the material is calculated. K.W.Plessner

621.319.4

7571 PROPERTIES AND BEHAVIOUR OF SOLID ELECTROLYTE TANTALUM CAPACITORS. W.Ackmann.

Nachrichtentech. Z. (N T.Z.), Vol. 13, No. 6, 261-5 (June, 1960). In German.

A review emphasizing the lower electrolyte resistance and hence the wider frequency range, particularly at low temperatures, of this type of capacitor compared with the liquid electrolyte type. The results of tests with impulses and switching surges and of a life test at elevated temperature are given. K.W.Plessner

621.319.4

7572 PRINTED ALUMINUM CAPACITORS.
F.Huber and W.Haas.
Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1482 (Aug., 1960).

The capacitors consist of anodized aluminium films on glass substrates, an evaporated aluminium counter-electrode being deposited on the oxide. Very good properties are reported as regards leakage current and power factor, and it is suggested that a working voltage only 10% below the forming voltage could be used. K.W.Plessner

621.319.42

7573 AGEING AND [DIELECTRIC] LOSSES OF IMPREGNANTS FOR CAPACITORS. H.Elsner.

Bull. Assoc. Suisse Elect., Vol. 51, No. 15, 733-9 (July 30, 1960). In German.

The deterioration of both mineral-oil and chlorinated-diphenyl impregnants in service are discussed. Tests such as the gassing test, to help in selecting suitable oils are described. With chlorinated impregnants the rigorous precautions necessary to avoid contamination are emphasized. Dielectric loss measurements are advocated as an indication of ageing in oils or of contamination in the chlorinated impregnants. K.W.Plessner

621.319.44

7574 EXPERIMENTAL 100 000 JOULE CAPACITOR BANK FOR PLASMA RESEARCH. R.Buser and P.Wolfert.

Electronics, Vol. 33, No. 32, 58-61 (Aug. 5, 1960).

Gives the simple theory underlying the design of capacitor banks suitable for use in the production of high magnetic fields or high-temperature plasmas. One practical system is described together with its associated triggering, switching, and timing circuits. G.D.Sims

621.319.45

7575 PURIFICATION OF TANTALUM ANODES DURING SINTERING. C.J.B.Fincham and G.L.Martin.

J. Electrochem. Soc., Vol. 107, No. 7, 658-60 (July, 1960).

Analyses were carried out for O_2, N_2, C and various metals before and after the sintering of Ta powder to make anodes for electrolytic capacitors. Apart from finding the degree of purification due to sintering treatments of different severity, the quality of anodes made from various grades of raw material was determined by measuring the leakage current after anodizing. A correlation of the quality of the anodes with residual impurity content is attempted. K.W.Plessner

LAMPS . ILLUMINATION

621.32

7576 LIGHT-SOURCES FOR VACUUM ULTRAVIOLET RAYS. F.J.Comes.

Z. InstrumKde, Vol. 68, No. 4, 69-76 (April, 1960). In German.

Ultraviolet radiation can be generated equally well in gasfilled discharge tubes as in special arrangements operating in high vacuum (synchrotron, vacuum spark). The emitted spectra are seldom pure line spectra. In many cases the lamps described here will emit continuous spectrum in a limited spectral region or sometimes over a wide range. Spectral lines are frequently superimposed on the continuous spectrum or in other spectral regions. The intensity of the emitted radiation can be very high for several types of light sources.

621.326

7577 ELECTRIC LAMPS CHARACTERISTIC EQUATIONS. R.Kovesligethy.

Rev. Electrotec., Vol. 46, No. 1, 1-5 (Jan., 1960). In Spanish.

A set of 21 equations relating the characteristics of tungsten filament lamps are formulated and briefly explained. The relation lamp-life/supply-voltage is further discussed to calculate the conversion factor "f" by which observed life time (under test conditions) must be multiplied to obtain the nominal life time. The mathematical and graphical solution is shown in a detailed worked example. J.W.Lee

621.327.4

7578 FLUORESCENT LAMP COLOUR DEVELOPMENTS. H.R.Ruff and F.E.Large.

Elect. Rev., Vol. 167, No. 11, 431-4 (Sept. 9, 1960).

An account of colour appearance and colour rendering of artificial light sources. Diagrams show the percentage conversion of the electrical energy into light, etc., and histograms on a 300 A band system are used for emission spectra of natural and artificial sources. An automatic recording spectrophotometer is described. The blending of phosphors to produce a desired spectral distribution from a fluorescent lamp is briefly discussed. S.T.Henderson

621.327.4

7579 THE NEW-YEAR TREE ILLUMINATIONS IN THE KREMLIN, EMPLOYING PULSE-DISCHARGE LAMPS.

G.N.Senilov.
Svetotekhnika, 1960, No. 9, 18-21. In Russian.

Pulse-discharge lamps, as used in various fields of signalling, have a greater effective lighting power than that shown by the

photometric value, and can be more readily observed against a constant background of light. Xenon lamps were employed, with a flashover energy of 15-20 J, with single-lamp units up to 800 J, operated from the 220 V supply in conjunction with a rectifier–capacitor circuit, providing 600 V across the lamp. A flashing frequency of 1 c/s was adopted as the visual optimum. A lamp life up to 1000 hr is indicated, together with other data showing corresponding values for the various expendable components.

R.Matthews

621.327.5

7580 SOME HIGH INTENSITY FLASH LIGHT SOURCES OF THE LUMINESCENT TUBE TYPE. R.Feinberg.

J. photogr. Sci., Vol. 8, No. 5, 183-6 (Sept.-Oct., 1960).

The design and performance of vacuum flash tubes of the cathode ray tube type are described in which short-duration impulses of a high-energy electron beam are used to excite a phosphor screen and thus to produce luminescent radiation pulses of high intensity. Triode type tubes are shown which may be operated with 2 kW pulses, and a diode type tube is described where the screen may be energized with 1 MW pulses. Either single-pulse radiation or trains of pulses with short pulse intervals can be produced, the duration of an individual radiation pulse ranging from about 0.1 μs to the order of 100 μs according to the rated value of the respective flash tube. The spectrum of the radiation is continuous with a form of the spectral curve depending on the type of phosphor used for the screen.

621.327.52

7581 THE XENON SHORT-ARC LAMP IN MOTION-PICTURE PROJECTION. B.Seeger and W.Jaedicke.

J. Soc. Motion Picture Televis. Engrs, Vol. 69, No. 7, 474-6 (July, 1960).

The high-pressure xenon discharge produces a spectral continuum in the visible range, with only a few superimposed lines. The resultant good colour-rendering properties make it suitable for projection of colour film. Lamps of 900 and 1600 W rating are now in common use in Europe. The conversion of a carbon-arc installation requires the provision of d.c. smoothing equipment and a lamp igniter. Best performance has only been obtained with specially designed housings. The advantage of the lamps are clean easy operation with a minimum of attention. Lives have been improved sufficiently to make the system economically attractive. With screens of up to 8 metres, good brightness is obtained. Attempts to use the lamps for larger screens by pulsed operation encounter difficulties. C.E.Williams

621.327.534

7582 A DECADE OF PROGRESS IN MERCURY LIGHTING. G.A.Freeman.

Westinghouse Engr, Vol. 20, No. 4, 116-20 (July, 1960).

Discusses the lamp improvements listed in Abstr. 5557 of 1960 together with advances in quartz tubing quality and use of phosphors (magnesium fluorogermanate for colour rendering and strontium zinc orthophosphate for high lumen output).

C.E.Williams

621.327.534.15

7583 IMPROVEMENTS IN FLUORESCENT LAMP EFFICIENCY FROM PARTICLE SIZE CONTROL OF PHOSPHORS. K.H.Butler and H.H.Homer.

Illum. Engng, Vol. 55, No. 7, 396-404 (July, 1960).

The phosphor is considered as a diffusing layer, and from Schuster's theory of absorption, calculations have been made to estimate lamp efficiency versus layer transmission for various values of the scattering constant. The latter is determined from the specific surface of the powder, and if low gives higher lamp efficiency. A phosphor powder was separated into fractions of different size ranges by air elutriation, and these fractions processed into lamps produced lumen outputs agreeing well with the calculations, the highest efficiency being about 75 lm/W for a 40 W lamp after 100 hr running. This used a fraction of particle size range 3 to 30 μ. In the discussion the question is raised of the doubtful value of the absorption coefficient in the arc of ultraviolet radiation reflected from the phosphor. S.T.Henderson

621.327.534.15 : 621.314.5

7584 OPERATION OF FLUORESCENT LAMPS FROM TRANSISTOR INVERTERS. R.Lehmann.

Lichttechnik, Vol. 12, No. 8, 449-51 (Aug., 1960). In German.

Tubular fluorescent lamps for lighting passenger transport vehicles may be operated from a d.c. supply, either battery or track by using them in circuit with a transistor inverter. The circuit is described and the voltage and current waveforms are shown. The efficiency of the lamps may be increased by using higher than normal frequencies. J.W.T.Walsh

621.327.534.15

7585 OPERATION OF THREE FLUORESCENT LAMPS ON A SINGLE PHASE SUPPLY. M.P.Carré.

Rev. gen. Elect., Vol. 69, No. 8, 434-6 (Aug., 1960). In French.

Describes a method of operating two lamps in a conventional twin-lamp circuit with parallel leading and lagging branches, a third lamp being connected in series with the common supply lead without an additional ballast. Substantially unity power factor is obtained with a marked reduction in stroboscopic effect. Vector diagrams and oscillograms are given. C.E.Williams

621.327.534.3

7586 LATEST EXPERIMENTS ON MODULATED HIGH-PRESSURE XENON ARCS. H.J.Hentschel.

Lichttechnik, Vol. 12, No. 7, 407-9 (July, 1960). In German.

A d.c. Xe arc was modulated with a.c. at frequencies up to about 25 kc/s and a number of the changes of characteristics were studied. In particular, the amplitude of the light modulation was found to be proportional to that of the modulating current for values of the latter up to about 45%. For a modulation of this amplitude at 10 kc/s the luminance at the centre of the arc was found to be greater than that of the unmodulated arc, while at the edges it was smaller, i.e. there was an apparent contraction of the arc. J.W.T.Walsh

628.971 : 612.8

7587 ACUITY OF VISION UNDER DIFFERENT KINDS OF LIGHT. P.Jainski.

Lichttechnik, Vol. 12, No. 7, 402-5 (July, 1960). In German.

The visual acuity of 11 observers of various ages was measured by the Landolt ring method with 5 different kinds of light, viz. W, Na, H.P.M.V., colour-corrected Hg and white fluorescent, the luminance levels ranging from 0.01 to 400 cd/m². The differences found were small, the range being about 25% at the highest luminance and 7% at the lowest. J.W.T.Walsh

628.972

7588 ADAPTATION ON RUNWAY AND TURNPIKE. D.E.Spencer and S.C.Peek.

Illum. Engng, Vol. 55, No. 7, 371-84 (July, 1960).

A general discussion of the characteristics of visual adaptation is followed by an examination of the effect of luminance distribution in the field of view on the minimum contrast just detectable. The findings are then applied to seeing conditions on the road and on an airfield runway. The treatment is extended to cover the presence of three degrees of fog and a comparison is made between different lighting arrangements, in particular those in which continuous lines of fluorescent lamps in cut-off fittings are used.

J.W.T.Walsh

628.972

7589 EVALUATION AND CONTROL OF BRIGHTNESS LEVELS FOR TELEVISION STUDIO LIGHTING. R.G.Williams.

J. Soc. Motion Picture Televis. Engrs, Vol. 69, No. 7, 470-4 (July, 1960).

Discusses the relationships between illumination, reflection factor, luminance and apparent brightness, and their importance in television studio lighting. The spectral sensitivity curve of a typical camera tube is compared with that of the eye.

J.W.T.Walsh

ELECTROCHEMISTRY

621.352.1

7590 MAGNESIUM–SULPHUR DRY CELLS. C.K.Morehouse and R.Glicksman.

J. Electrochem. Soc., Vol. 107, No. 7, 651-2 (July, 1960).

Reasons for the selection of sulphur and magnesium as the cathode and anode respectively for primary battery construction are given. The construction of a magnesium–sulphur cell is described including the composition of the cathode paste. Performance characteristics are illustrated graphically. Open-circuit

voltage is 1.60 to 1.65 V, operating voltage is 0.9 to 0.95 V. Advantages and disadvantages are listed. The liberation of hydrogen sulphide gas during discharge limits its broad application. W.A.Walker

621.352.13 : 621.327.4

7591 BATTERIES AND TRANSISTORS. R.Vic.
Rev. gen. Elect., Vol. 69, No. 7, 366-8 (July, 1960). In French.

The combination of a battery of air-depolarized primary cells employing an alkaline electrolyte with gas-discharge lamps and a transistorized multivibrator to convert the d.c. into a.c. provides a method of signalling, independent of mains supply, of unprecedented economy and reliability. Provided the current drain is small the air-depolarized cell will maintain its voltage over a very long period and the use of these cells, coupled with a transistorized chopper having no moving parts ensures the reliability of the a.c. supply to the discharge lamp. The fact that the lamp will provide an acceptable standard of brightness over a voltage range of 8.7 to 4 V and will continue to function down to 2.5 V makes it possible to make full use of the available battery capacity and enhances the economy of the system. D.R.Way

621.352.3

7592 CURRENT VIEWS ON THE PROCESS OF DEPOLARIZATION IN CELLS OF THE MANGANESE DIOXYDE TYPE. J.Brenet.
Rev. gen. Elect., Vol. 69, No. 7, 355-8 (July, 1960). In French.

Manganese dioxyde, used as a depolarizing agent in the Leclanché-type dry cells which form the bulk of modern production, includes a number of isotopes. The most common of these includes βMnO_2, is not an effective depolarizer, and this action is mainly the work of the isotopes αMnO_2 and λMnO_2. The accepted formulae $2\,MnO_2 + H_2 \rightarrow Mn_2O_3 + H_2O$ no longer offers a satisfactory explanation of the chemical action which takes place in a Leclanché cell and it seems probable that the effect of the depolarizing agent is catalytic. Although it is too early yet to predict radical improvements in the capacity obtainable from Leclanché-type dry cells research on the lines indicated is proceeding in a number of countries. D.R.Way

621.352.3

7593 SOME STUDIES ON THE SUBJECT OF DRY BATTERIES. R.Huber.
Rev. gen. Elect., Vol. 69, No. 7, 358-61 (July, 1960). In French.

Tests on experimental cells in which the depolarizing agent is split into three distinct layers indicate that its action is concentrated in the layer directly in contact with the zinc anode. By using the isotope λMnO_2 as a depolarizing agent and by agitating the electrolyte to ensure that the whole of the depolarizer is effective it is theoretically possible to produce cells of greatly enhanced capacity, but such cells are a long way from being realized industrially and present development is on the lines of increasing the porosity of the depolarizer to improve the rate of diffusion of the electrolyte. D.R.Way

621.352.3

7594 CONSIDERATIONS ON THE BEHAVIOUR OF MAGNESIUM AS AN ANODE IN PRIMARY CELLS. A.Grund and F.Jolas.
Rev. gen. Elect., Vol. 69, No. 7, 361-3 (July, 1960). In French.

Magnesium is attractive as an anode material in primary cells because of the high energy output theoretically obtainable. In practice, when plunged into an electrolyte, a magnesium electrode becomes covered with a layer of porous magnesium hydroxide which lowers the e.m.f. of the cell. It is nevertheless still sufficiently high, when compared with zinc, to be worth further study, and research is being directed towards overcoming voltage instability at the moment of commencement of a discharge and spontaneous chemical reduction of the anode while the cell is on open circuit. The latter can be minimized by the addition of chromates to the electrolyte, but the additional protection thus afforded to the anode increases the initial overvoltage on discharge. D.R.Way

621.352.3

7595 "ONE – SHOT" SILVER CHLORIDE – MAGNESIUM CELLS FOR LIFE SAVING AT SEA. J.Fafa.
Rev. gen. Elect., Vol. 69, No. 7, 364-6 (July, 1960). In French.

Limited storage life of conventional dry cells in a saline atmosphere has led to the development of sea-water-activated batteries for use on life rafts etc. These cells employ magnesium for the negative electrode and silver chloride for the positive and are inert until plunged into the sea. The chlorine and magnesium salts in sea water make it an entirely satisfactory electrolyte for this couple and the cells have a high energy output and maintain their voltage well on load. Further advantages are that the e.m.f. is virtually the same as that of a conventional dry cell, making it possible to use standard bulbs and radio equipment, and the cells can be wired permanently in circuit so that the apparatus begins to function as soon as sea water enters the cells. D.R.Way

621.355.163

7596 A PARALLEL BATTERY FULL FLOAT SYSTEM FOR 40 VOLT MANUAL EXCHANGES. P.K.Roychoudhury.
Telecommunications (Jabalpur), Vol. 9, No. 1, 46-52 (June, 1959).

States the advantages of three different floating battery systems over charge–discharge working, and outlines the design of a floating system suitable for manual exchanges in India. An untried circuit is given of an exchange using parallel-battery full-float working, with two rectifier chargers fitted with automatic voltage control: the switching, instrumentation and alarm systems are described in detail. E.F.Hansford

621.355.2 : 621.389 : 628.9

7597 A STUDY OF EMERGENCY LIGHTING. L.Amy and C.Mounios.
Electricien, Vol. 88, 169-79 (Sept., 1960). In French.

Summarizes French regulations in regard to the emergency lighting of hospitals, cinemas etc. and discusses their practical application with particular reference to the employment of stationary batteries of the lead–acid type. The advantages are stressed of the "maintained", as against the "non-maintained", system. In the latter case poor battery maintenance could result in there being no emergency supply available in the event of a mains fault. To avoid the need to employ a battery of large capacity a compromise solution is put forward, in which a proportion of the lamps are normally supplied from the battery, while the remainder of the lamps are brought into circuit by a relay which trips on the failure of the mains supply. Various means of overcoming the consequent battery voltage fluctuation are considered. D.R.Way

621.355.29

7598 LEAD-ACID STORAGE BATTERIES IN TELEPHONE SERVICE. R.C.Shair.
Trans Amer. Inst. Elect. Engrs II, Vol. 79, 1-5 (1960) = Applic. and Industr. No. 47 (March, 1960).

Some of the chemistry, physics and engineering aspects of lead-acid storage batteries are discussed. In telephone service storage batteries serve as an emergency reserve and as a crosstalk or noise filter. For the greater part of their life they are maintained in float-type operation when the overcharge or polarization characteristics govern their behaviour; normal charge and discharge characteristics only effect their behaviour in rare emergency cycling. Calcium alloy used for grids has brought significant improvements over antimony alloy grids in lead-acid batteries. The former alloy leads to a life expectancy of 25 years instead of 15 years for the latter. Other characteristics are also discussed. W.A.Walker

621.355.2

7599 LIFE TESTING OF POWER VEHICLE BATTERIES. E.Flegler and W.Stein.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 10, 244-9 (May 16, 1960). In German.

A method for life testing of power batteries by introducing a mechanical vibration superimposed on an overcharging and discharging cycle in an attempt to simulate practical operational conditions is described. The standard D.I.N. 72311/7 life test is critically examined. More results from the test are required but the new method indicates that, under conditions of mechanical vibration and overcharging, antimony precipitates from the surface of antimony alloy plates causing degradation of the plate. Sketches of the test circuits and graphs are given. W.A.Walker

621.357.7

7600 MECHANIZATION AND AUTOMATION IN ELECTROPLATING. O.Mudroch.
Elektrotech. Obzor, Vol. 49, No. 7, 337-43 (1960). In Czech.

Discusses the merits of mechanization and automation in this field. Describes various automatic types of plating machines: (a) those with mechanized and automatic transfer of components to semi-automatic machines; (b) straight-line semi-automatic and fully automatic machines; (c) closed-circuit fully automatic machines. Illustrations of machines and the general arrangement of a machine design in Czechoslovakia are given. N.Klein

ELECTRIC HEATING

621.362

7601 THE THERMOELECTRIC CONVERSION OF ENERGY. P.Aigrain.

Bull. Soc. Franc. Elect. (Ser. 8), Vol. 1, No. 1, 441-7 (July, 1960). In French.

A brief introduction to the subject of conversion of heat into electricity by thermoelectric and thermionic means. The use of modern semiconductors for this purpose is considered as well as their potential use in refrigeration. G.D.Sims

621.382 : 621.362

7602 THEORETICAL BOUND ON THE THERMOELECTRIC FIGURE OF MERIT. F.J.Donahoe.

Elect. Engng, Vol. 79, No. 6, 488-90 (June, 1960).

It is shown that for extrinsic semiconductors the maximum value of the figure of merit ($z = S^2\delta/k$) occurs at $S = \pm 172(k/k_g)\mu V/^\circ K$ where k and k_g are the total and lattice thermal conductivities respectively. The absolute value of z depends on the mobility and effective mass of the free charge carriers and the lattice thermal conductivity; under favourable conditions a value of $z = 17.10^{-3}$ deg^{-1} at 300°K is postulated. D.J.Huntley

621.362

7603 THE EFFECT OF SOURCE AND SINK THERMAL RESISTANCE ON THERMOELECTRIC GENERATOR PERFORMANCE. P.E.Gray.

Trans Amer. Inst. Elect. Engrs III, Vol. 79, 15-19 (1960) = Commun. and Electronics, No. 47 (March, 1960).

Previous treatments of thermoelectric generator performance have assumed that the temperatures of the hot and cold junctions do not depend on the heat flow. In practical arrangements, both the source and sink have what may be called a thermal resistance, so that, for example, the temperature of the hot junction is lowered if the heat drawn from the source is increased. Formulae for energy conversion efficiency are derived and it is shown that in typical cases the effect of this correction is not negligible. P.M.Davidson

621.362

7604 FUEL CELLS: WILL THEY SOON BECOME A MAJOR SOURCE OF ELECTRICAL ENERGY? F.T.Bacon.

Nature (London), Vol. 186, 589-92 (May 21, 1960).

In fuel cells the free energy of combustion of a fuel is converted directly into electrical energy. They can be divided into three groups: those working at atmospheric temperature up to about 100° C; those working at a medium temperature, about 200° C; and those working at a high temperature, about 550° C and upwards, with electrolytes of fused salts. The reacting gases in medium-temperature cells are usually hydrogen and oxygen; their theoretical efficiency is about 83% (based on the total heat of the reaction) at atmospheric temperature and pressure, and can be 55% at 200° C and a pressure of 400 lb/in^2. With 10 inch diameter electrodes, the current may be as large as 320 A. The largest battery built in this country has 40 cells with a performance of 100 A at 32 V and 240 A at 24 V. Opinions are divided about the practical possibilities of the hydrogen–oxygen cell, chiefly because hydrogen is expensive and difficult to store. But the cell is inherently suitable for traction and has aroused considerable interest in the United States and, more recently, in Germany. E.W.Golding

621.365

7605 TRANSIENT RESPONSE AND RIPPLE EFFECTS IN THERMOELECTRIC COOLING CELLS.

N.Alfonso and A.G.Milnes.

Elect. Engng, Vol. 79, No. 6, 443-9 (July, 1960).

A simple thermoelectric cell is considered in which the physical parameters are assumed to be independent of temperature. The steady-state condition is examined and the temperature drop (ΔT) is given as a function of current for several values of l/a (the ratio of length to area of the thermoelements). For a perfectly insulated chamber the maximum ΔT is independent of l/a but occurs at different currents. The transient response to a step current is analysed by Laplace transform methods and the results given for various currents; at large currents the response is more rapid and overshoot exhibited. Ripple currents lead to a relative increase of Joule heating to Peltier cooling but in some cases 40% ripple produces a negligible effect on ΔT. D.J.Huntley

621.365.2

7606 ESTIMATION OF THE PROPERTIES OF AN ARC FURNACE BY THE METHOD OF CURRENT INDICES. T.Schwartz.

Arch. elektrotech. (Warsaw), Vol. 8, No. 2, 301-12 (1959). In Polish.

A method of estimating the optimum working current range of an arc furnace and checking on the basis of furnace parameters whether requirements for any operating conditions can be met. The conditions for max. throughput and min. energy consumption are investigated and expressed in terms of the current. The expressions for the limiting values of current are evolved and current indices introduced for evaluation of the working current range on the basis of easily definable values of X and R. The technique of using current indices can be simplified by the use of suitable nomograms. The accuracy of the method is discussed and a worked example given. W.J.Grek

621.365.511 : 621.315.668.1

7607 WOOD-WORM DESTRUCTION BY H.F. FIELDS. A.M.Thomas.

Elect. Times, Vol. 138, 121-3 (July 28, 1960).

Experiments are described on the sterilization of insect infested wood by 75 Mc/s radio-frequency fields, using oak blocks containing larvae of the Lyctus powder-post beetle as test material. Both direct and stray field heating were employed. With direct heating, the temperature of the wood must reach 65° C, in not less than 40 sec to ensure 100% mortality. Stray field heating is recommended where only one side of the wood is accessible. No evidence of differential heating of the larvae was found. R.F.S.Hearmon

ELECTRIC WAVES AND OSCILLATIONS

621.371

7608 PROPAGATION OF ELECTROMAGNETIC WAVES IN A SEMI-INFINITE CONDUCTING MEDIUM. P.Szulkin.

Arch. elektrotech. (Warsaw), Vol. 8, No. 1, 103-21 (1959). In Polish.

Examines the problem of radiation of a vertical electric dipole in a conducting medium along a boundary plane with a lossless medium. The e.m. field is calculated explicitly for the assumed propagation model and the defined boundary values. Z.F.Voyner

621.371

7609 A RECIPROCITY THEOREM FOR NONPERIODIC FIELDS. G.Goubau.

I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 3, 339-42 (May, 1960).

By the use of Fourier transforms, the reciprocity theorem for electromagnetic fields emanating from two independent sources can be converted into a form applicable in the time domain. The theorem yields all the results which can be derived from the classical formulation but is more general in that it applies also in the case where either or both of the sources are moving. (The classical theorem fails in this case as the field of a moving source is never periodic in the entire space). A suitable form of the theorem is derived for application to problems similar to that of signal transmission between a satellite and a ground station. G.D.Sims

621.371

7610 THE GROWTH OF LONGITUDINAL WAVES PROPAGATING IN A PLASMA. G.F.Filimonov.

Radiotekhnika i Elektronika, Vol. 4, No. 1, 75-87 (Jan., 1959). In Russian.

A unique solution of the one-dimensional linearized dispersion equation describing the propagation of a high-frequency signal generated by an external signal is found. Electron beams with a

square and Maxwellian electron velocity distribution in the undisturbed state are examined as examples. It is shown that for small electron temperatures the usual single-velocity approximation can be used. Analysis of the expressions obtained make it possible to establish the propagation direction of waves in the plasma and to solve the problem of growing waves in rectilinear electron flow. It is concluded that the assertion that growing waves in such systems cannot be described by the dispersion equation is incorrect. [English summary: PB 141106T-12, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.]. R.C.Glass

LINES . NETWORKS . FILTERS

621.372.2

7611 THEORY OF THE GOUBAU SURFACE WAVE. P.Szulkin.
Arch. elektrotech. (Warsaw), Vol. 8, No. 2, 313-26 (1959). In Polish.

An analysis of the Harms-Goubau surface wave is given. An approximate expression for the attenuation of the wave is derived. A.E.Karbowiak

621.372.2

7612 ANALYSIS OF R.F.I. IN TRANSMISSION LINES AND FILTERS. D.C.Ports, A.R.Howland, Jr and R.M.Moore.
Electronic Industr., Vol. 19, No. 7, 93-100 (July, 1960).

A general article discussing the transmission line (waveguide, coaxial line) as a complex frequency-dependent, coupling mechanism introduced between the aerial and transmitter. The role of statistical analysis is outlined. A.C.Brown

621.372.2

7613 MISCONCEPTIONS ABOUT EQUIVALENT CIRCUITS FOR PERIODIC MICROWAVE STRUCTURES. R.M.Bevensee.
I.R.E. WESCON Convention Record, Vol. 4, Pt I, 3-10 (1960).

This paper seeks to prove that an analysis of a slow wave structure coupled to an electron beam as based on a likely "equivalent" circuit may not agree with a field analysis, in which a solution of Maxwell's equations leads to a different equivalent circuit. A typical slow wave structure is described by an "equivalent" circuit for the beam-circuit interaction. Maxwell's equations are then solved for one of the cavities with its fields expanded in the one resonant π-mode of the "cold" structure. An equivalent circuit is obtained for the electric and magnetic field amplitudes, as excited by the beam, which differs from the first "equivalent" circuit. The beam equations are then solved, excited by cavity electric field and subject to the periodicity condition. The result is a determinantal equation for the allowed phase shift per period, which is checked by a solution of Maxwell's equations with the fields expanded in the one resonant O-mode of the "cold" structure. The growing waves near cutoff by the field analysis differ significantly from those waves in the likely "equivalent" circuit. It is concluded that only the field analysis and its ambiguous equivalent circuit is reliable. The analysis corresponds very generally to using a variational expression for ω, in which the trial fields are expanded in sets of resonant cavity modes.

621.372.2

7614 THE SOLUTIONS FOR NONUNIFORM TRANSMISSION LINE PROBLEMS. I.Sugai.
Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1489-90 (Aug., 1960).

The generalized equation for nonuniform transmission line can be transformed into a Reccati differential equation. This cannot be solved for the general case but a solution is possible if a relationship is assumed between the distribution of series impedance and shunt admittance per unit length along the line. Solutions are given for the two special cases of constant amplitude and constant phase. W.T.Blackband

621.372.4

7615 ON PARTIAL EQUIVALENCE IN CONNECTION WITH A THEOREM OF COCCI-CAUER. K.H.R.Weber.
Hochfrequenztech. u. ElektAkust., Vol. 68, No. 4, 118-21 (Nov., 1959). In German.

If all bipoles are considered which contain up to four elements, it may be determined that many exist which contain more than a single ohmic resistance. There exist no bipoles which contain more than two ohmic resistances if circuits are excluded which contain redundant elements. The number of bipoles with two ohmic resistances is 38. The Cocci–Cauer theorem states that any bipole containing two and more ohmic resistances can be substituted by a bipole containing only a single ohmic resistance. When this theorem is applied to the set of 38, two of their number are partially equivalent. Their properties are examined in some detail. S.C.Dunn

621.372.4/.5

7616 ZEROS AND POLES OF OUTPUT VOLTAGE OF 3-TERMINAL POTENTIOMETER NETWORKS. M.A.Abdel-Messih.
Z. angew. Math. Phys., Vol. 10, No. 2, 207-15 (1959).

It is shown that, in a 3-terminal network of fixed resistors with a finite number of potentiometers on a common shaft, fed with a constant voltage, the output voltage E2 is a rational function of the angle of rotation x of the shaft ($0 < x < 1$), and that the zeros of $E_2(x)$ are either real outside the interval $0 < x < 1$, or occur in conjugate complex pairs. The poles of $E_2(x)$ are simple real negative, or >1. W.G.Stripp

621.372.41

7617 CHARGE AND DISCHARGE OF A NON-LINEAR CONDENSER THROUGH A LINEAR NON-DISSIPATIVE INDUCTANCE. A.Mozumder.
Z. angew. Math. Phys., Vol. 8, No. 4, 261-80 (July 25, 1957).

Develops a mathematical theory for the oscillatory charge and discharge of an exponential and a sinh type capacitor through a linear lossless inductance with direct voltage applied. Voltage and current waveforms obtained by numerical solution of the integral equations are given. Discusses possible applications. D.J.Truslove

621.372.412

7618 FREQUENCY–TEMPERATURE–ANGLE CHARACTERISTICS OF AT- AND BT-TYPE QUARTZ OSCILLATORS IN AN EXTENDED TEMPERATURE RANGE. R.Bechmann.
Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1494 (Aug., 1960).

Following an earlier paper (see Abstr. 1433 of 1957) which covered the temperature range -60° to $+100^\circ$C, measurements have been extended from -200° to $+250^\circ$C when it is shown that the third-order coefficient satisfactorily explains the frequency–temperature characteristics. The actual values of the first-, second- and third-order temperature coefficients of frequency, and their derivatives with orientation, are also in good agreement with those obtained earlier. A.P.C.Thiele

621.372.412 : 621.314.2

PIEZOELECTRIC VOLTAGE TRANSFORMERS.
See Abstr. 7214

621.372.413 : 538.56

7619 TIME DELAY AND FREQUENCY RESPONSE OF RESONANT CAVITIES. A.G.Mungall and D.Morris.
Canad. J. Phys., Vol. 38, No. 11, 1510-15 (Nov., 1960).

It is found that a signal travelling through a resonant cavity undergoes a time delay dependent on both the cavity Q and also the difference between the signal and resonant frequencies. The time for a frequency-modulated wave is calculated and checked experimentally.

621.372.413

7620 PIEZOELECTRIC RESONATOR AS AN ELECTRICAL QUADRIPOLE. J.Zelenka.
Slaboproudy Obzor, Vol. 21, No. 7, 387-92 (1960). In Czech.

A piezoelectric resonator with four electrodes is considered. The resonator is either in the form of a rod or a narrow plate and it can vibrate longitudinally or flexurally. It is shown that the system can be regarded as an electrical quadripole. General expressions for the components of the admittance matrix of the quadripole are derived and explicit formulae are given for some special cases. The admittance components take into account the friction losses, but neglect the radiation loss. In the derivation of the admittances it is assumed that the distribution of the displacement along the resonator is a cosine function. From the formulae it is found that a longitudinally vibrating resonator can be made into an asymmetrical quadripole by a suitable positioning of the electrodes. In the case of a flexurally operating resonator, the

asymmetry can only be achieved by using six electrodes. A method of measuring the parameters of the quadripole is briefly indicated. R.S.Sidorowicz

621.372.414

7621 HELICAL RESONATOR DESIGN CHART. W.W.Macalpine and R.O.Schildknecht.
Electronics, Vol. 33, No. 33, 140, 142, 144, 146 (Aug. 12, 1960).

Detailed design information is presented and discussed for coaxial resonators (tunable if required by a maximum of ±10%) with helical inner conductors. A nomogram is given together with examples of its use. A further graph indicates the useful range with regard to operating frequency, unloaded Q, and physical dimensions. Limit frequencies are probably between 2 Mc/s (o.d. = 7.0 inch) and 1 Gc/s (o.d. = 0.7 inch). Unloaded Q's range from 400-2000 according to size and frequency. A.P.C.Thiele

621.372.5

7622 APPLICATION OF THE GAUSSIAN PRINCIPLE OF LEAST CONSTRAINT TO ELECTRICAL NETWORKS. A.von Weiss.
Arch. elekt. Übertragung, Vol. 14, No. 5, 235-6 (May, 1960). In German.

In generalized coordinates the Gaussian principle of least constraint can be expressed as a product of a force coordinate and the second derivative of a position coordinate. This expression enables the application of the principle to electrical networks and leads to Kirchhoff's theorems. J.M.Silberstein

621.372.5

7623 THE MATRIX OF AN ITERATIVE NETWORK FROM A SIMILAR 4-POLE NETWORK (REPRESENTATION OF THE ARBITRARY EXPONENT OF A MATRIX). G.Doetsch.
Arch. elekt. Übertragung, Vol. 14, No. 8, 335-40 (Aug., 1960). In German.

A four-terminal network is characterized by a matrix M, which links voltage and current at the input terminals with the same quantities at the output terminals. If n equal four-terminal networks are connected in cascade, the matrix of the resultant four-terminal network is equal to M^n. For the matrix M^n an explicit expression is given, which can be calculated easily in practical cases where the elements of M are complex quantities, since only hyperbolic functions are used, which are also tabulated for complex arguments.

621.372.5

7624 CONTRIBUTIONS TO THE GENERAL STUDY OF PHASE-SHIFT NETWORKS [OF THE PASSIVE QUADRIPOLE TYPE]. A.Braier and H.Rosman.
Bull. Inst. Politeh. Iasi, Vol. 5(IX), No. 1-2, 291-302 (1959).

621.372.5

7625 APPARATUS FOR AUTOMATICALLY DETERMINING THE IMAGINARY PART FROM THE REAL PART OF A NETWORK FUNCTION OF MINIMUM PHASE-SHIFT TYPE, AND VICE-VERSA. V.Pollak.
Hochfrequenztech. u. ElektAkust., Vol. 69, No. 1, 7-11 (Feb., 1960). In German.

Describes a simple analogue circuit which takes the known frequency response, in the form of a repetitive time–waveform obtained by frequency scanning, and produces an output waveform corresponding to the shape of the wanted response curve. V.G.Welsby

621.372.5

7626 GENERAL PROPERTIES OF THE PROPAGATION CONSTANT OF A NONRECIPROCAL ITERATED CIRCUIT. R.N.Carlile.
Proc. Inst. Radio Engrs, Vol. 48, No. 6(I), 1162-3 (June, 1960).

Considers the propagation constant of an infinitely long chain of two-port networks containing nonreciprocal elements and such as might be used in a travelling-wave tube or parametric amplifier. A number of known properties of slow-wave circuits are re-established from the general treatment. G.D.Sims

621.372.5

7627 THEORY OF DESIGN OF FOUR-POLE CIRCUITS, CONTAINING DISSIPATIVE ELEMENTS, TO HAVE PRESCRIBED INSERTION CHARACTERISTICS. Nai-Ta Ming.
Hochfrequenztech. u. ElektAkust., Vol. 68, No. 6, 190-3 (Jan., 1960). In German.

This is concerned with the classification of four-pole circuits in terms of the various conditions which have to be met if the circuit is to be physically realizable. V.G.Welsby

621.372.5

7628 NETWORKS AND THE USE OF MATRICES IN THE ALGEBRA OF VARIABLE ELECTRICAL CIRCUITS. C.Bellomi.
Ingegn. Ferroviaria, Vol. 15, No. 3, 188-210 (March, 1960). In Italian.

A study is made of the relationships between the circuit matrices and the topography of networks. An example is given to show how a complicated series-parallel structure may be reduced to a much simpler equivalent network. V.G.Welsby

621.372.5

7629 PERIODICALLY VARYING LINEAR NETWORKS. T.Kasami and H.Ozaki.
J. Inst. Elect. Commun. Engrs Japan, Vol. 43, No. 5, 590-7 (May, 1960). In Japanese.

Presents a basic matrix approach to the analysis and synthesis of networks which consist of a finite number of periodically varying linear lumped elements. A systematic s-domain method analogous to the conventional method is proposed. A.Wilkinson

621.372.5

7630 I.R.E. STANDARDS ON CIRCUITS: DEFINITIONS OF TERMS FOR LINEAR PASSIVE RECIPROCAL TIME INVARIANT NETWORKS, 1960.
Proc. Inst. Radio Engrs, Vol. 48, No. 9, 1608-10 (Sept., 1960).

621.372.5

7631 I.R.E. STANDARDS ON CIRCUITS: DEFINITIONS OF TERMS FOR LINEAR SIGNAL FLOW GRAPHS, 1960.
Proc. Inst. Radio Engrs, Vol. 48, No. 9, 1611-12 (Sept., 1960).

621.372.5

7632 DESIGN AND USE OF RC PARALLEL-T NETWORKS. G.White.
Proc. Nat. Electronics Conf., Vol. 15, 92-104 (1959).

The RC parallel-T network with a transmission null at f_0 is described and the symmetrical lattice approach to its analysis is outlined. Following a notation of Guillemin, general equations for the response are given in terms of a minimum number of design parameters. The selection of design parameters for various principal applications, with relevant references to published work, is given in detail. The common applications requiring a response curve symmetrical about f_0, such as the single-frequency notch filter, the a.c. derivative network and the frequency discriminator are treated. In this class falls the feedback amplifier with a very narrow notch. Typical feedback amplifier circuits giving band-pass response are presented, and the design of networks for either one-pole or n-pole response is described. As particular examples, stagger-tuned pairs and an equivalent net for two-pole response in a single stage are analysed. A typical oscillator circuit is shown as a special case of the band-pass amplifier. Centre frequencies down to a fraction of 1 c/s are easily obtained. The use of the parallel-T as a low-pass or a high-pass is covered briefly, and it is shown how a net of more complexity can be derived to give an improvement in response. Using the symmetrical lattice equations, typical examples are worked out. The resulting networks are usually three T-nets in parallel or a triple-T. A simple feedback amplifier for obtaining a response equal to an m-derived LC filter is described as a further solution to the problem. The engineering problem of component selection for network stability is discussed, since this is a major consideration in designing satisfactory circuits. Frequently, stability is the only problem not readily solved by the potential user. Temperature compensation techniques are given, together with typical experimental data on temperature errors.

621.372.5

7633 THE CIRCUITRY FOR SCATTERING MATRIX SYNTHESIS. K.L.Su.
Proc. Nat. Electronics Conf., Vol. 15, 928-36 (1959).

A collection of scattering matrix combinations and their corresponding network interconnections are given. Among them are several novel suggestions. They include a scheme that averages two scattering matrices, a means to add two matrices with different relative weights, and a device to add two matrices directly.

621.372.5

7634 TRANSFER FUNCTION OF GROUNDED TWO-PORTS WITH ONE INDUCTOR. S.L.Hakimi.
Proc. Nat. Electronics Conf., Vol. 15, 937-44 (1959).

It was shown by DeClaris (see Abstr. 7655 of 1960) that the driving-point functions of a network consisting of resistors, capacitors, and one inductor can have no more than one pair of complex poles and possibly one pair of complex zeros. From DeClaris' result, one can conclude that any transfer function of such networks can have no more than one pair of complex poles. It is shown that any RLC realizable transfer function, which has no more than one pair of complex poles, can be realized as an RC network terminated in a series combination of an inductor and a resistor. Therefore, available inductors which are inherently lossy may be used to terminate the RC network.

621.372.5

7635 THE EFFECT OF ELEMENT TOLERANCES ON CASCADED FOUR TERMINAL NETWORKS.
E.A.Worrell and H.J.Yost.
Proc. Nat. Electronics Conf., Vol. 15, 945-57 (1959).

Derives a general equation for a circuit consisting of theoretically identical cascaded sections with element tolerances included. The difficulty of multiplying a large number of non-identical matrices, which is the case with tolerances included, is overcome by a matrix transformation and splitting. The resulting is in a single matrix form, from which any of the circuit functions may be taken. The voltage transfer function is given in a series, whose successive terms contain a higher order of tolerance. A statistical study results in the derivation of the mean and standard deriviation of the voltage transfer function. Examples are given to show the application of the general equation to practical circuits.

621.372.5 : 621-5

7636 PRACTICAL APPLICATIONS OF SIGNAL FLOW GRAPHS USING AN ARRAY OF NON-TOUCHING LOOPS. G.S.Axelby and R.H.Plath.
Proc. Nat. Electronics Conf., Vol. 15, 1044-55 (1959).

Discusses systematic, practical methods of drawing and using signal flow diagrams. A simple, tabular array is given from which various combinations of non-touching loops may be found and used to determine transfer characteristics directly from the flow graphs. This simple device eliminates the usual duplication or neglect of loop combinations which are not obvious. It is shown that, when used systematically, signal flow graphs provide a more efficient method of solving certain types of problems than do other conventional methods using determinants of matrices. As shown, flow graphs replace tedious manual calculations with shorter and more rapid mental tasks. Other practical advantages of using flow graphs are described: the automatic isolation of each element for ease in computing return difference and sensitivity, the constant dimensional check, the elimination of redundant mathematical manipulations, and the determination of multiple loop stability. Finally, several examples, taken from actual engineering problems, are given to illustrate the method and advantages of systematically drawing flow diagrams and using the simple array of non-touching loops to determine transfer characteristics quickly and accurately with a minimum of manual labour.

621.372.5

7637 THE KRON METHOD OF TEARING AND THE DUAL METHOD OF IDENTIFICATION. A.I.Weinzweig.
Quart. appl. Math., Vol. 18, No. 2, 183-90 (July, 1960).

Describes the rigorous mathematical formulation of Kron's method for solving electrical network problems. While the previous work (see Abstr. 3583 of 1959) involves tearing the network into smaller components and then solving each of these simpler sub-units and so forming the solution of the original problem, the present article simplifies the procedure. It also generalizes the method using the known solutions and yields a new identification (dual) method. By the latter, the solution matrix is inverted by inverting two other matrices which are respectively of a rank greater and less than the original. In some cases the inverse of the first matrix is easily computable, leading to a simpler solution. Thirteen references are quoted.

621.372.54

7638 THE CHOICE OF FILTERS WITH A SUITABLE PULSE RESPONSE. O.Herrmann and W.Schüssler.
Arch. elekt. Übertragung, Vol. 14, No. 4, 183-9 (April, 1960).
In German.

Usual requirements for pulse shaping networks are discussed, and a merit factor is introduced which enables the comparison and appraisal of pulse networks. Roughly speaking, the merit factor is the product of the highest passed frequency and of the duration of the pulse front. The procedure for obtaining networks with a desired frequency response and pulse shape, by means of an analogue computer, is explained. Characteristic time functions of several known pulse networks are shown in graphs. Similar characteristics are shown for polynomial filters of 2nd to 6th order.

J.M.Silberstein

621.372.54

7639 THE INFLUENCE OF LINEAR TRANSMISSION SYSTEMS ON WIDE-BAND NOISE PHENOMENA. H.Schlitt.
Arch. elekt. Übertragung, Vol. 14, No. 6, 239-46 (June, 1960).
In German.

Autocorrelation functions are derived and tabulated for a number of simple filter types (ideal low-pass, ideal high-pass, practical RC low-pass, Gauss' low-pass, practical RC high-pass, ideal narrow-band, ideal wide-band) to the input of which is applied wide-band noise; this is defined as a stochastic phenomenon with practically constant power density and a frequency spectrum much wider than that of the filter. It is shown that in the limiting case of white noise the autocorrelation function can be presented by a Dirac delta function. Relations are analysed between autocorrelation functions and pulse transfer functions, enabling a direct comparison of parameters of the statistical and the classical system theory. One of the results obtained is a particular case of Middleton's theorem for optimal filters. J.M.Silberstein

621.372.54

7640 ELECTRICAL WAVE FILTERS WITH PRESCRIBED CHARACTERISTICS. J.B.Fischer.
Arch. elekt. Übertragung, Vol. 14, No. 7, 283-98 (July, 1960).
In German.

Two different approaches to filter design are available: wave parameter theory (transfer constant and wave impedance) and insertion-loss theory. It is shown that prescribed characteristics can be realized by designing the filter on the basis of the wave parameter theory, and that the number of components is not very much greater. Simple though accurate relations are established between quadripole and insertion parameters, and their application is illustrated by calculating a low-pass filter with a cut-off frequency of 60 kc/s and a band-pass filter for 48.3-51.4 kc/s.

J.M.Silberstein

621.372.54

7641 FILTERS WITHOUT INDUCTORS FOR EXTREMELY LOW FREQUENCIES. H.G.Jungmeister and H.L.König.
Arch. elekt. Übertragung, Vol. 14, No. 7, 317-24 (July, 1960). In German.

RC filters with particularly sharp cut-off characteristics are surveyed. Design formulae and characteristics are given for: usual twin-T filter, supplementary sections for response sharpening, supplementary L-sections for low-and high-pass filters. Active band-pass filters (filter-amplifiers) are also considered, viz. the pentode filter, the cascode filter with a Q factor of 100, cascode filter with negative d.c. feedback. Design information is also given for an active low-pass filter. J.M.Silberstein

621.372.54

7642 SIMPLIFYING FILTER DESIGN. K.Lichtenfeld.
Electronics, Vol. 33 No. 21, 96-9 (May 20, 1960).

Tables derived using a Chebyshev approximation (due to Cauer) are presented enabling evaluation of the elements of two-section low pass, high pass, band pass and band elimination "Zobel" type filters. Both the series and shunt case are treated and worked examples of all types are given. A.P.C.Thiele

621.372.54

7643 TUNING FORK FOR HIGH-Q RESONANCE. W.J.Holt.
Electronics, Vol. 33, No. 21, 108, 110 (May 20, 1960).

A filter utilizing a dual tuning-fork assembly, with a drive coil and magnet between one pair of tines, and a pick-up coil between the other pair, is described. This arrangement is claimed to have good isolation between input and output and since it is balanced the effects of external vibration are reduced. A typical 1600 c/s unit has

the following characteristics: input and output impedance 1500 ohms; input voltage 2 V r.m.s; relative attenuation at 20 c/s and 20 kc/s, 60 dB; Q = 5000; centre-frequency stability ±0.01%; operating temperature 0-70°C. A.P.C.Thiele

621.372.54

7644 ON THE SIGNS OF THE CHARACTERISTIC PARAMETERS OF SYMMETRICAL QUADRIPOLES.

É.V.Zelyakh.

Elektrichestvo, 1960, No. 6, 41-6 (June). In Russian.

An argument is advanced for the necessity of sign determination of parameters in filter networks in order to help in filter design. An analytical and graphical approach is used. Lattice sections are considered as well as π- and T-networks. Some theorems are formulated and examples of application to simple network sections demonstrated. T.Horrocks

621.372.54

7645 ELECTROMECHANICAL QUADRIPOLES AS COUPLING FILTERS. E.Trzeba.

Hochfrequenztech. u. ElektAkust., Vol. 69, No. 3, 108-17 (June, 1960). In German.

Following the analogy between electrical and mechanical circuits, narrow-band filter operation of mechanical resonators is investigated. The advantages of distributed circuits are demonstrated and a composite equivalent circuit derived for a filter with appropriate input and output couplings. S.C.Dunn

621.372.54 : 621.376.5

OPTIMUM COMBINATION OF PULSE SHAPE AND FILTER TO PRODUCE A SIGNAL PEAK UPON A NOISE BACKGROUND.

See Abstr. 6808

621.372.54 : 621.391

7646 A THEORY OF ENHANCEMENT FILTERS. A.Norris.

I.R.E. WESCON Convention Record, Vol. 4, Pt 2, 3-12 (1960).

Criteria for maximizing a linear sum of signal samplings when the r.m.s. noise output of the system is constant are given. The maxima given by two waveforms is then related to that for a superposition system. A discussion is presented for a more complex system with δ-function frequency selection and time delayed signals.

621.372.54

7647 H.F. FILTERS, A SURVEY OF PROBLEMS AND CIRCUITS. M.Borchert.

Radio Mentor, Vol. 26, No. 4, 262-8 (April, 1960). In German.

The requirements of h.f. filters, the terminology and definitions used and factors likely to affect their operation are broadly considered. The review presents in tabulated form the characteristics of the lumped and distributed resonant circuit elements forming fixed and tunable bandpass and bandstop types; compensating elements of the simple, double, symmetric and perfect type; bridge filter circuits using lumped constants and coaxial transmission lines; 90° couplers and constant impedance input filters. Z.F.Voyner

621.372.54 : 621.391

7648 FILTERING BY MEANS OF TIME-VARYING R(t)C CIRCUITS. Z.Nenadal.

Slaboproudy Obzor, Vol. 21, No. 7, 398-402 (1960). In Czech.

A simple R(t)C circuit in which R(t) is a function of time is considered. A direct-current signal together with stationary random noise is applied to the input of the circuit, the output being taken across C. A formula for the minimum output noise is derived. This permits the evaluation of R(t) on the basis of the power spectrum of the noise, provided the spectrum is expressed as a ratio of two polynomials $M(\omega^2)/N(\omega^2)$, such that $N(\omega^2)$ is one degree higher than $M(\omega^2)$. A signal $g(t) = a_k t^k$, where a_k is a constant and k is a positive integer, is then assumed. In this case the filtering is done by a system consisting of a multiple differentiator which converts the signal into d.c., an R(t)C network and a circuit which multiplies the resulting output by t^k. Filtering of the signals of the type $g(t) = \sum_{k=0}^{n} a_k t^k$ can be achieved by using more complex systems. R.S.Sidorowicz

621.372.542

7649 THEORY OF A MONOLITHIC NULL DEVICE AND SOME NOVEL CIRCUITS. W.M.Kaufman.

Proc. Inst. Radio Engrs, Vol. 48, No. 9, 1540-5 (Sept., 1960).

An important trend in modern electronics is toward decreased size and increased reliability of electronic systems. A new simple structure is discussed which performs the function of a twin-T network, i.e., a null output is produced at a single frequency. This new structure has the advantage of being very small, simple to fabricate, and easy to use in conjunction with transistorized circuits. The theory of operation of the device, experimental verification of the theory, and some circuits containing the device are also discussed. The structure has been found useful to create a high-Q tuned amplifier, an oscillator, and a threshold transducer. The physical simplicity of the structure should result in a high degree of reliability and uniformity of response. It should be noted that the structure can be fabricated from semiconductor materials and is thus suited to "molecularized" or "integrated" solid-state systems.

621.372.542.2

7650 DESIGN OF NETWORKS WITH PRESCRIBED DELAY AND AMPLITUDE CHARACTERISTICS.

J.K.Skwirzynski and J.Zdunek.

Marconi Rev., Vol. 23, 115-39 (3rd Qtr, 1960).

A general and flexible design method for reactive quadripoles with specified group delay characteristics is presented supplemented by suggesting means of equalizing attenuation without effecting delay. This design method can obviously be extended to cover any frequency band. For the purpose of clarity of presentation, the discussion is confined to low-pass filters which are intended to pass signals of frequencies limited to a symmetrical band round zero and which can be realized as ladder structures between two resistive terminations.

621.372.542.21

7651 A SIGNAL FLOW GRAPH METHOD FOR DETERMINING LADDER NETWORK FUNCTIONS. G.H.Burchill.

Proc. Inst. Radio Engrs, Vol. 48, No. 6(I), 1175 (June, 1960).

621.372.543.2

7652 A CONTINUOUSLY VARIABLE BANDPASS FILTER FOR AUDIO FREQUENCIES. W.Ohme.

Frequenz, Vol. 14, No. 5, 182-6 (May, 1960). In German.

A double modulation process enables the responses of two bandpass filters to be superimposed in such a way that an overall bandpass characteristic is obtained which is variable both as regards its mid-band frequency and its band-width. Relatively sharp cut-offs are achieved, with a minumum stop-band attenuation of 60 dB. V.G.Welsby

621.372.543.2

7653 RECURRENCE FORMULAE FOR THE CALCULATION OF THE CHARACTERISTIC FUNCTION OF FILTERS WITH TCHEBYCHEFF PASS-BAND BEHAVIOUR. A.Fettweis.

Rev. H.F., Vol. 4, No. 10, 230-9 (1960).

Recurrence formulae are established which permit a systematic mechanical computation of the coefficients of the numerator and denominator polynomials of the filter characteristic function, starting from the cut-off frequencies, the attenuation poles and the amplitude of the Chebyshev ripple in the pass-band. Separate formulae are given for symmetric and antimetric low-pass band-pass filters.

621.372.543.3

7654 VARIABLE TUNING FERRITE FILTERS. B.M.Beskorovainyi, V.M.Vol'f, V.S.Gorbenko, M.I.Karnovskii, B.I.Shotskii and A.A.Yur'ev.

Radiotekhnika, Vol. 15, No. 9, 57-63 (Sept., 1960). In Russian.

The core arrangement resembles a three-limb transductor. The material used is a nickel–zinc ferrite type ϕ-2000 with an effective permeability of 2000. Permalloy has been considered but has undesirable temperature and frequency characteristics. The core is gapped to the extent of 0.4%. Two kinds of nonlinearity are discussed: that between permeability and controlling field and that between permeability and the amplitude of the signal. The natural temperature coefficient of the ferrite is about 0.7% per deg C; used as a core of the form described the effective coefficient is three times smaller. An application is briefly described to an acoustic spectrometer which covers a range from 40 c/s to 15 kc/s in five steps. The attenuation half an octave away is greater than 45 dB, and one octave away, greater than 60 dB. S.C.Dunn

621.372.57

7655 THE ACTIVE CONSTANT-RESISTANCE LATTICE. R.E.Thomas.

Proc. Nat. Electronics Conf., Vol. 15, 727-37 (1959).

A major practical difficulty associated with most methods of active RC synthesis is the difficulty of obtaining proper alignment. A useful procedure for reducing the alignment problem is cascade synthesis and one method of cascade synthesis is the constant-resistance lattice. The passive constant-resistance lattice technique is extended to active networks in which the available network elements are positive and negative resistors and capacitors. A method is presented for synthesizing constant-resistance sections which realize a pair of unrestricted zeros and a pair of left-half plane poles. Three procedures are given for reducing the lattice to an unbalanced equivalent two-port made up of resistors, capacitors and negative-impedance convertors (n.i.c.). N.I.C. biasing requirements are met by inserting resistance into the lattice at an appropriate stage of the decomposition process. Sensitivity properties of the active lattice are analysed and it is shown that proper evaluation can be made only in terms of classical sensitivity since the poles of the constant-resistance lattice always have infinite root sensitivity. The procedure for controlling the sensitivity properties of the lattice is largely one of trial and error but the results are competitive with other methods of RC-n.i.c. synthesis. Several examples of sensitivity computations are given to illustrate the theory.

621.372.57

7656 A NEW THEORY OF THE ACTIVE QUADRIPOLE AND ITS APPLICATION TO AN AMPLIFIER WITH DISTRIBUTED GAIN. E.V.Zelyakh.

Radiotekhnika, Vol. 15, No. 8, 13-24 (Aug., 1960). In Russian.

New parameters are introduced for active quadripoles described as voltage and current characteristics. A theory is developed for cascaded matched active quadripoles and design formulae given for input and output voltages and currents for arbitrary loads. Application is then made to the analysis of a distributed-gain amplifier; the expression for the amplification factor takes account of mismatches in both grid and anode circuits. S.C.Dunn

621.372.6

7657 ANALYTICAL EXPRESSION FOR THE CONFIGURATION OF AN ELECTRICAL CIRCUIT. T.Cholewicki.

Arch. elektrotech. (Warsaw), Vol. 8, No. 1, 39-62 (1959). In Polish.

Electrical circuits can be considered as consisting of a number of $n + 1$ closed meshes on the Gaussian plane or of a number of $p + 1$ nodes. Their characteristics are represented by generalized symmetrical matrices of impedance Z_{n+1} or admittance Y_{p+1} which are independent of the reference mesh or node. Circuits are classified according to the number of meshes and their topology. The relations of the number of possible configurations and of the number of zero elements in the matrix are studied for various values of $n + 1$. The current-coupling matrix C and voltage-coupling matrix A are then generalized as $(\Gamma_{n+1}, m)_t$ and $(\Delta_{p+1}, m)_t$ respectively, where $(\Gamma_{n+1}, m)_t(\Delta_{p+1}, m)_t = 0$, m being the number of branches. It is concluded that a circuit can be expressed analytically by its four generalized matrices, their order and properties indicating the circuit topology and characteristics. See also Abstr. 911-12 of 1956. Z.A.A.Krajewski

621.372.6

7658 THE SCATTERING MATRIX OF A GENERAL INTERCONNECTION OF MULTIPOLES. T.A.Abele.

Arch. elekt. Übertragung, Vol. 14, No. 6, 262-8 (June, 1960). In German.

The scattering matrix is used in the theory of complex networks when the dimensions are comparable with the wavelength, so that the description by currents and voltages at the terminals is no longer feasible. Conditions are set which have to be satisfied for the scattering matrix to be usable as a description of the network. On the basis of the scattering matrix of unconnected partial multipoles, the scattering matrix of the entire mesh is derived by the inversion of the partial matrix, a triple matrix product and two matrix additions. The method is illustrated by an example. J.M.Silberstein

621.372.6

7659 CALCULATING BANDWIDTHS FOR MATCHING NETWORKS. H.B.Yin.

Electronic Industr., Vol. 19, No. 7, 70-4 (July, 1960).

An extension of matching design normally carried out by the application of the Smith chart. Phase shift is involved in calculating the elements from the formulae. Also values obtained from the chart are not accurate for impedances located close to the rim of the chart. Therefore a new set of formulae for matching networks (T or Π sections or half-sections and 4-element networks) has been developed. T.Horrocks

621.372.6

7660 THE NODE SYSTEM OF EQUATIONS. W.C.Peterson and J.J.LaRue.

J. Franklin Inst., Vol. 270, No. 3, 175-89 (Sept., 1960).

The minimum number of simultaneous equations and unknowns required to describe the behaviour of an electrical network is in many cases obtained by considering the independent node voltages to be the unknown variables. However, the usual techniques for writing node equations are not applicable to networks containing ideal voltage sources not incident to the reference node. The node system of equations for general networks with ideal current and voltage sources arbitrarily located, is derived on the basis of a particular type of cut-set or segregate matrix, and a novel method for writing the node equations of such networks by inspection is presented. The application to networks containing vacuum tubes, transistors and magnetic coupling is illustrated.

621.372.6

7661 GENERAL N-PORT SYNTHESIS WITH NEGATIVE RESISTORS. H.J.Carlin.

Proc. Inst. Radio Engrs, Vol. 48, No. 6(1), 1174-5 (June, 1960).

A mathematical demonstration that an admittance, impedance or scattering matrix may be synthesised in terms of passive elements and negative resistors. Since negative resistors imply an active network the demonstration is limited to generalized realizability. T.Horrocks

621.372.6

7662 A DIFFERENT APPROACH TO THE APPROXIMATION PROBLEM. S.Deutsch.

Proc. Inst. Radio Engrs, Vol. 48, No. 6(1), 1175-6 (June, 1960).

Synthesis of networks is demonstrated. An analytical approximation is derived first. This may lead to an infinite series. An approximation is then derived. The number of elements used to get a reasonable approximation is rather large however and the values of capacitors used are unreasonably large. T.Horrocks

621.372.6

7663 TRANSMISSION AND HYBRID PARAMETERS FOR N-PORT NETWORKS. L.P.Huelsman.

Proc. Nat. Electronics Conf., Vol. 15, 920-7 (1959).

The usual method of determining the transmission parameters for two-port networks is not always applicable to networks which have a greater number of ports. For example, in a set of parameters in matrix form relating the quantities V_1, I_1 and V_2 to the quantities I_2, V_2 and I_2, an element of the matrix might be defined: $\alpha_{11} = V_1/I_2$, evaluated for the conditions $V_2 = I_2 = 0$. Establishing these conditions, however, is clearly impractical. A solution to this problem is presented by developing the general matrix formulation for determining the transmission parameters of an n-port network from the z, y or hydrid parameters of that network. Based on this formulation, a theorem is presented which states the conditions under which any arbitrary set of parameters of an n-port network may be realized from any other given set. Application of the theorem is made to a specific three-port network and also to show and tabulate the relations between the various two-port network parameters.

621.372.6

7664 ON THE QUESTION OF "JUMPS" IN ELECTRICAL NETWORKS. S.A.Drobov.

Radiotekhnika, Vol. 15, No. 7, 29-36 (July, 1960). In Russian.

A linear passive two-terminal network Z (p) can be represented as L_0, R_0 and a number of parallel RC sections, all in series. For a non-linear network a relation $E = Z(p)i + e$ is assumed. This is used to derive "jumps" limits of a ferroresonant circuit. The theory is extended to three-terminal networks and the calculations are applied to a transformer-coupled triode, a transistor trigger, a multivibrator and a blocking oscillator as examples. Z.A.A.Krajewski

621.372.63

7665 TRANSFORMATIONS OF ACTIVE NETWORKS. N.De Claris.
Proc. Nat. Electronics Conf., Vol. 15, 707-17 (1959).

The use of "controlled" sources significantly broadens the scope of modern network theory and makes possible a theory for active networks with both analysis and synthesis aspects. The basic properties of "controlled" sources as genuine network elements are first established and their role in duality, network transformation and realization is discussed. "Controlled" source transportations are presented for altering a network structure without affecting its terminal behaviour. Y–Δ transformations of active networks are developed and illustrated.

621.372.63

7666 SYNTHESIS OF THREE-POLE, NARROW BAND INTERSTAGES. A.Sances and J.J.Hupert.
Proc. Nat. Electronics Conf., Vol. 15, 738-46 (1959).

Any desirable pattern of poles in a narrow-band configuration can be synthesized by adjusting centre frequency and attenuation of every resonant unilateral stage in a cascaded chain of resonant amplifiers. In order to save on the number of active devices, it is usually desirable in multipole networks to use more complicated interstages, double, or triple tuned. The problem of synthesizing double-tuned stages being simpler, a method is given of rigorously finding the values of circuit elements corresponding to an arbitrary disposition of poles, both symmetrical and asymmetrical, provided the narrow-band approximation is satisfied. This can be done without solving the third order equation by anticipating a convenient circuit structure.

WAVEGUIDES

621.372.8 : 621.317.34

MEASUREMENT OF PARAMETERS OF DIELECTRIC LINES AT MM WAVELENGTHS IN AN OPTICALLY COUPLED RESONATOR. See Abstr. 7425

621.372.8 : 621.317.34

2 INCH DIAMETER WAVEGUIDE: ATTENUATION MEASUREMENTS AT 50 TO 90 Gc/s. See Abstr. 7430

621.372.81

7667 A PHYSICAL CLASSIFICATION OF ELECTROMAGNETIC WAVES. H.E.M.Barlow.
Proc. Instn Elect.Engrs, Vol. 107B, 552 (Nov., 1960).

621.372.81

7668 THE RISE-TIME AND OVERSHOOT OF TRANSIENTS IN WAVEGUIDES. S.Kuliński.
Arch. electrotech. (Warsaw), Vol. 7, No. 4, 669-91 (1958). In Polish.

Mathematical expressions are derived for the rise time and other characteristics of the wavefront of a transient transmitted through a waveguide. The results are illustrated by numerical examples. A.E.Karbowiak

621.372.812

7669 REFLECTION OF THE FUNDAMENTAL MODE AT WAVEGUIDE JUNCTIONS, IN PARTICULAR AT A GRADUAL TRANSITION FROM A RECTANGULAR TO A CIRCULAR WAVEGUIDE. K.Schnetzler.
Arch.elekt. Übertragung, Vol. 14, No. 4, 177-82 (April, 1960). In German.

Propagation of the fundamental mode in a waveguide with continuously slowly-changing cross-section is analysed, and reflection formulae are derived for some examples. Expressions are derived for the reflection of the fundamental mode in the case of a slow and gradual transition from a circular waveguide (with the same axis) and for a similar transition from a rectangular to a circular waveguide. Good agreement is obtained with measured values. J.M.Silberstein

621.372.821

7670 THE APPLICATION OF PRINTED CIRCUIT TECHNIQUES TO MICROWAVE SYSTEMS.
K.Foster and A.C.Brown.
Brit. Commun. and Electronics, Vol. 7, No. 8, 584-9 (Aug., 1960).

Describes the potentialities of strip transmission line with particular reference to high-Q triplate types. Measurement techniques and performances of components are given. Applications to complicated systems and aerials are outlined. A.C.Brown

621.372.821

7671 THE LAUNCHING OF SURFACE WAVES BY A MAGNETIC LINE SOURCE.
C.M.Angulo and W.S.C.Chang.
Proc. Instn Elect. Engrs, Monogr. 411 E, publ. Oct., 1960, 10 pp. To be republished in Part C.

Deals with the idealized problem of the excitation of surface waves along two infinite, identical, separate and parallel dielectric slabs by a magnetic line source (slot). The problem is reduced to a superposition of simpler ones, namely, two parallel slabs with symmetrical excitation and two parallel slabs with antisymmetrical excitation. The simplified problems are solved by the modal-analysis approach, and the synthesis of the modal components is carried out to obtain the far fields excited by the magnetic line. Radiation pattern, total power of the surface waves, total radiation loss and the efficiency of launching the surface wave are derived and computed numerically for various thicknesses of the slabs, various air-gaps between the slabs and different positions of the magnetic line source. The theoretical results indicate that, for each thickness of the slabs, high efficiency is obtained with an optimum location of the source and an optimum air-gap. Moreover, the thicker the slabs, the higher is the maximum efficiency. The thickness of the slabs and the air-gap are ultimately limited by the requirement that only one surface wave should exist for the structure.

621.372.821.2

7672 SYMMETRICALLY EXCITED TRANSDUCER FOR CROSS-POLARIZED H_{11} WAVES. E.Schuegraf.
Frequenz, Vol. 14, No. 4, 121-3 (April, 1960). In German.

Symmetrical excitation of a circular waveguide in the H_{11} mode, via coaxial probes, is proposed to avoid generation of unwanted modes, such as E_{01}. In one arrangement of the transducer, such an excitation is used for one polarization of the H_{11} mode. The perpendicularly polarized H_{11} mode is fed through a rectangular waveguide coaxial with the circular waveguide carrying a dielectric rod. The complete transducer is stated to give an isolation between the two polarizations of better than 40 dB. A.E.Karbowiak

621.372.821.2

7673 TRANSMISSION PROPERTIES OF H_{01} WAVEGUIDES WITH STATISTICALLY DISTRIBUTED IRREGULARITIES. H.Larsen.
Frequenz, Vol. 14, No. 4, 135-42 (April, 1960). In German.

A theoretical analysis of the effects of random irregularities of an overmoded waveguide on its propagation characteristics. Particular attention is given to the effect of random variation of the radius of curvature on the mode conversion–reconversion in waveguides used for long-distance communication. A.E.Karbowiak

621.372.822

7674 THE ROTATION OF THE PLANE OF POLARIZATION IN A TWISTED SQUARE WAVEGUIDE. K.Schnetzler.
Frequenz, Vol. 14, No. 4, 123-6 (April, 1960). In German.

A mathematical treatment of the H_{01} wave propagation in a twisted square waveguide is given using the generalized telegraphists equations. It is concluded that for a gradual twist the cross-coupling between the two polarized waves is about −37 dB for 1° of twist, and this figure is independent of the length of the twisted section. The coupling depends only on the angle between the end cross-section and for an angle of 111° a complete transfer of energy takes place between the two polarizations. A.E.Karbowiak

621.372.822

7675 NORMAL MODES METHOD FOR BOUNDARY-EXCITED WAVE GUIDES. J.Van Bladel.
Z. angew. Math. Phys., Vol. 9a, No. 2, 193-201 (1958).

Using the normal mode method a complete set of equations is derived for the electromagnetic field inside a cavity with volume- and surface-excitation sources. The use of the equations is illustrated by the application to the excitation of a rectangular waveguide by an inclined slot.

621.372.829

7676 THE HELIX AS A WAVEGUIDE TRANSMISSION MEDIUM. G.Piefke.

Nachrichtentech. Z. (N.T.Z.), Vol. 13, No. 7, 335-41 (July, 1960). In German.

This is a discussion of approximate formulae for the propagation parameters of helical waveguides of the kind suitable for long-distance transmission. Various types of waveguide are described and the use of the formulae is illustrated by two numerical examples

A.E.Karbowiak

621.372.829 : 538.56

7677 ELECTROMAGNETIC WAVE PROPAGATION IN WAVEGUIDES CLOSE TO PERIODIC. A.A.Sharshanov and K.N.Stepanov.

Zh. tekh. Fiz., Vol. 27, No. 7, 1474-81 (July, 1957). In Russian.

Calculates with the aid of Vladimirskii's equations [Zh. tekh. Fiz., Vol. 17, 1269 (1947)] the propagation of a wave of frequency ω in a chain of cavity resonators of radii b_n, length l_n, eigen-frequency ω_n, connected by the apertures of radii a_n, where $a_n \ll b_n, a_n \ll l_n$, $a_n \ll c/\omega_n$ and $\omega \approx \omega_n$. The special case is discussed where the cavities and apertures (radius a_-) are the same for $n \leq 0$, and similarly for $n \geq N + 1$ (aperture radius a_+), a travelling wave being found with slowly varying phase and amplitude. A special solution is found when the wave frequency ω is close to the edge of the pass-band. The case of a cylindrical waveguide loaded with dielectric disks is treated by generalizing the results of Fainberg and Khizhnyak [Zh. tech. Fiz., Vol. 25, 711 (1955)], the disk arrangement being assumed in this case to deviate gradually from the periodic. Finally, the solution of difference equations with slowly varying coefficients is discussed.

D.E.Brown

621.372.831.11

7678 NON-REFLECTING WAVEGUIDE TAPERS. H.E.M.Barlow.

Proc. Instn Elect. Engrs, Paper 3318E, publ. Nov., 1960 (Vol. 107B, 515-21).

Much work has already been done towards establishing techniques for tapering the cross-section of waveguides without introducing significant reflections when waves are propagated along them. Here, the problem is approached from the aspect of maintaining a completely undisturbed field pattern outside the guide whatever its cross-section, so that the wave impedance remains constant. Examples are given illustrating how this result may, in principle, be achieved both for the hollow metal guides of rectangular and circular cross-section and for single-wire transmission lines. On the basis proposed, it is shown that the surface impedance of the guide must always have a resistive component which has nothing to do with losses but is dependent solely upon the angle of the taper and represents energy crossing the interface from the field on one side to the field on the other.

621.372.832

7679 A NON-CONTACTING, BROADBAND ROTARY JOINT, AND FOUR-WAY SWITCH. D.Alstadter and N.A.Dawson.

I.R.E. WESCON Convention Record, Vol. 4, Pt 1, 34-42 (1960).

The coaxial rotary joint uses simple non-contacting capacitive coupling between the movable parts. It is essentially a broadband device. The four-way rotary switch utilizes quarter wavelength choke coupling between strip transmission lines. The mechanical construction of the prototypes, capable of efficient operation at speeds in excess of 3000 per/min. is described. A.E.Karbowiak

621.372.832.4

7680 THE 3 dB COUPLER. W.Stösser.

Frequenz, Vol. 14, No. 4, 117-21 (April, 1960). In German.

A brief theory of a short slot coupler is given followed by a discussion of its properties. It is shown that by reducing the breadth of the waveguide in the coupling region an improvement in overall performance can be achieved. A.E.Karbowiak

621.372.832.8

7681 A FAST-SWITCHING X-BAND CIRCULATOR UTILIZING FERRITE TOROIDS. L.Levey and L.M.Silber.

I.R.E. WESCON Convention Record, Vol. 4, Pt 1, 11-20 (1960).

Non-reciprocal waveguide devices were constructed utilizing permanently magnetized ferrite tubes. The use of ferrite elements of this geometry make possible the realization of ferrite assemblies without the need of a magnet. For switching purposes, the remanent state of the ferrite material may be reversed by the application of current pulses to a wire inserted through the tube. Utilizing this arrangement, a differential phase-shift circulator was developed which operates over the frequency range of 8.2 to 9.2 Gc/s. The loss between coupled ports is 0.6 dB or less and the isolation between uncoupled ports is 25 dB or greater. The circulator can be switched in less than 0.5μs. Permanently magnetized ferrite toroids were also employed in waveguide-T coaxial geometries. Preliminary results are presented.

621.372.832.8

7682 STRIP-LINE Y CIRCULATOR. S.Yoshida.

Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1337-8 (July, 1960).

The circulator consists of a Y-strip conductor set between two conducting planes forming a tri-plane Y-junction. Circulator action is obtained by disposing symmetrically thin garnet discs between the ground planes, and magnetizing the same by means of a permanent magnet. Insertion loss of 0.3 dB and 23 dB isolation has been obtained over a 100 Mc/s bandwidth in L-band.

A.E.Karbowiak

621.372.833

7683 COUPLING OF COAXIAL TRANSMISSION LINES AND WAVEGUIDE. F.Andueza.

Rev. Telecom, Vol. 15, 20-5 (March, 1960). In Spanish.

Considers the coupling of coaxial transmission lines to waveguide as an aerial problem, in which the coaxial cable is a dipole. Two cases are given, one where the waveguide is open at both ends, the second in which one end is terminated by a short-circuit. Equivalent circuits are drawn, and expressions for the "radiation resistance" of the dipole are derived. A.C.Brown

621.372.837

7684 ARC DISCHARGE, MICROWAVE SWITCH TUBE. S.J.Tetenbaum, R.R.Moats and D.L.Campbell.

I.R.E. WESCON Convention Record, Vol. 4, Pt 3, 96-102 (1960).

The switch tube consists of a short length of waveguide sealed by mica windows at both ends, and filled with a suitable gas. Switching results from a grid-initiated arc-discharge across the waveguide, between suitably mounted electrodes. The tube can handle peak powers of the order of 80 kW and two models one for X- and one for C-band have been built and tested. Good figures for bandwidth, recovery time and hold-off power are reported.

A.E.Karbowiak

621.372.837.2 : 621.396.96

7685 V.S.W.R. AND LOSS RESPONSE OF A BALANCED DUPLEXER VERSUS DISTANCE BETWEEN THE MAGNETRON AND GAS DISCHARGE CELLS. B.E.Rubinshtein.

Radiotekhnika, Vol. 15, No. 7, 16-20 (July, 1960). In Russian.

Examines the conditions prevailing in a balanced duplexer with pre-TR cells during the reception of a radar signal. When the cells introduce a change of phase the losses in the receive condition substantially depend on the distance between the magnetron and the gas switches. The cold magnetron was simulated by a variable reactance. The experimental results, for a change of phase up to 30° and various values of v.s.w.r. due to the magnetron, show good agreement with the theory. Z.F.Voyner

621.372.852.15

7686 BROADBAND ELECTRONICALLY-TUNED MICROWAVE FILTERS. K.L.Kotzebue.

I.R.E. WESCON Convention Record, Vol. 4, Pt 1, 21-7 (1960).

It has been suggested that single crystals of yttrium iron garnet can be used in the construction of low-loss microwave filters which can be tuned by means of an applied d.c. magnetic field. Practical broadband circuits in coaxial line and waveguide for both single and multiple-tuned band-pass and band-reject filters using such crystals are discussed. One version of a band-pass filter has operated with electronic tuning from 2.0 to 6.5 Gc/s. The insertion loss was 3 dB at 2.0 Gc/s, 1 dB at 4/0 Gc/s, and 0.7 dB at 6.5 Gc/s, with bandwidths ranging from 18 to 40 Mc/s. A packaged version of this filter is described which utilizes a combination of permanent magnets and solenoids for tuning. The complete filter weighs less than 2.5 lb and can be tuned ±1.0 Gc/s from 3.0 Gc/s with a power consumption of 5W.

621.372.852.22

7687 FEATURES OF CYLINDRICAL WAVEGUIDES CONTAINING GYROMAGNETIC MEDIA. R.A.Waldron.
J. Brit. Instn Radio Engrs, Vol. 20, No. 9, 695-706 (Sept., 1960).

A number of results are resented of computations of the electromagnetic field components and density of energy flow, as functions of position in the tranverse plane, for the H_{11} mode in a cylindrical waveguide of radius a containing a concentric ferrite rod of radius b. Typical values are chosen for the ferrite properties, and three values of a (normalized with respect to wavelength) that are likely to be found in practice. Values of b/a ranging from 0 to 1 are taken. This paper continues and concludes work published earlier by the author (see Abstr. 1595, 2250 of 1959). In the present work, the aim is not only to present field components and power distributions for given values of a and b, but also to show how these vary as a and b vary. The results are discussed in relation to each other and to the phase-constant curves previously obtained. It is concluded that the behaviour of these cylindrical systems is mainly dependent not on the ratio b/a but on b alone.

621.372.852.3

7688 PARAMETRIC PHASE DISTORTIONLESS L-BAND LIMITER. A.D.Sutherland and D.E.Countiss.
Proc. Inst. Radio Engrs, Vol. 48, No. 5, 938-9 (May, 1960).

Following a suggestion of Siegman (Abstr. 4207 of 1959) a limiter operating at 1000 Mc/s utilizing a voltage-sensitive diode in a cavity similar to those used for parametric amplification has been constructed. The cavity has two idling frequencies F_1 and F_2, the signal (F_p) (which is also the pump) is coupled in and out by means of two separate loops. Limiting was found to occur when $F_1 + F_2 = F_p$ and was optimum when $F_1 = F_2 = F_p/2$. Over 30 dB of dynamic limiting has been observed and phase-distortion measurements which are described in detail made over a 16 dB range show there is less than ± 2% of phase distortion.

A.P.C.Thiele

621.372.852.4

7689 A DISPERSIONLESS DIELECTRIC QUARTER WAVE PLATE IN CIRCULAR WAVEGUIDE. R.D.Tompkins.
Proc. Inst. Radio Engrs., Vol. 48, No. 6 (I), 1171-2 (June, 1960).

With the help of the given curves it is possible to design a quarter-wave plate to produce an almost perfectly circularly polarized wave over a substantial bandwidth. One design described uses a stepped quarter-wave plate made of polystyrene in a 1⅜ in. i.d. circular waveguide. It generates a wave which deviates from a perfectly circularly polarized wave by no more than 2% over the band 8.5-9.6 Gc/s.

A.E.Karbowiak

621.372.852.5

7690 DESIGN OF A TWO-STEP WAVEGUIDE TRANSFORMER. W.Haken.
Frequenz, Vol. 14, No. 4, 126-31 (April, 1960). In German.

Theory and a design method for a two-step waveguide transformer is given. It is shown that with a suitable design the reflection coefficient, at a junction between two rectangular waveguides of unequal cross-section, can be minimized over a given bandwidth. For a particular transformer operating around 4 Gc/s good agreement between theory and experimental results was established.

A.E.Karbowiak

621.372.852.5

7691 A NEW H_{10}-TO-H_{20} MODE TRANSDUCER. C.C.Eaglesfield, Y.Klinger and L.Solymar.
Proc. Instn Elect. Engrs, Paper 3305E, publ. Nov., 1960 (Vol. 107B, 512-14).

Using a general method of mode-transducer design previously described, a simple H_{10}-to-H_{20} mode transducer was constructed. The reflection coefficient is calculated, and it is shown that for a transducer a few wavelengths in length the reflections are insignificant. The power transferred to the spurious modes was measured by the resonance method on two experimental models, 2 and 8 guide-wavelengths long. The longer transducer transforms 92% of the power into the required mode. The power in unwanted modes can be greatly reduced by the use of a simple absorptive mode filter.

621.372.853

7692 THE BLOCK LOADED GUIDE AS A SLOW WAVE STRUCTURE. W.B.Mims.
Proc. Inst. Radio Engrs, Vol. 48, No. 6(1) 1176-7 (June, 1960).

The structure discussed is essentially a rectangular waveguide (as used for H_{01} mode propagation) loaded periodically with copper blocks. There are three distinct modes of operation and by varying the proportions of the structure it is possible to adjust the propagation parameters within wide limits. Structures having Q-factors in excess of 1000, loss ½ dBm and slowing factor of 20 were constructed, but greater slowing factors would be expected if Al_2O_3 or $Ti\,O_2$ ceramics were used as spacers. The structure has some advantages as a slow-wave element in travelling-wave masers.

A.E.Karbowiak

621.372.853.1

7693 PROPAGATION ALONG UNBOUNDED AND BOUNDED DIELECTRIC RODS. II. PROPAGATION ALONG A DIELECTRIC ROD CONTAINED IN A CIRCULAR WAVEGUIDE. P.J.B.Clarricoats.
Proc. Instn Elect. Engrs, Monogr. 410 E, publ. Oct., 1960, 10 pp. To be republished in Part C.

Describes both approximate and exact methods for evaluating the phase-change coefficients of a circular waveguide containing an axial dielectric rod. Close correlation is found between the phase-change coefficients of this waveguide structure and those of an unbounded rod over a wide range of rod radii. The correlation enables an unambiguous classification of the modes of an unbounded rod to be made. Exact and perturbation expressions are derived for total transmitted power, power distribution and attenuation in the dielectric-rod-waveguide structure. Correlation with the attenuation coefficients of an unbounded rod is again predicted. The application of the results to ferrite devices is briefly mentioned.

621.372.853.2

7694 CONSTRUCTION OF UNIDIRECTIONAL ISOLATORS FOR THE 3 cm WAVEBAND. Z.Frait.
Slaboproudy Obzor, Vol. 21, No. 8, 449-54 (1960). In Czech.

An isolator for a rectangular waveguide (of 22.86 × 10.16 mm cross-section) was constructed from a manganese-magnesium ferrite produced in Czechoslovakia. The characteristics of the isolator were measured over the range of 8.8-9.5 Gc/s. The isolation ratio was plotted as a function of the magnetic field and the geometrical parameters of the device. Isolation ratios of 60 could easily be obtained over the whole frequency bandwidth, while in the centre of the range they could be as high as 150. The s.w.r. over the band was better than 1.1. The isolator is employed in microwave measuring equipment.

R.S.Sidorowicz

621.372.853.2 : 538.56

7695 NON-PERIODIC SLOW-WAVE AND BACKWARD-WAVE STRUCTURES. P.J.B.Clarricoats and R.A.Waldron.
J. Electronics and Control, Vol. 8, No. 6, 455-8 (June, 1960).

The behaviour of the phase constant as a function of frequency is examined in the neighbourhood of cut-off for a waveguide of circular cross-section containing a concentric rod of dielectric or ferrite material. It is predicted from this behaviour that with suitable choices of geometry and properties of the rod, slow waves or backward waves will propagate.

OSCILLATORS . PULSE GENERATORS

621.373.1

7696 ELECTROMECHANICAL SYSTEMS WITH VARIABLE INDUCTANCE. M.Marinesku.
Elektrichestvo, 1960, No. 6, 50-8 (June). In Russian.

A review of previously published work (28 references) with suggestions for future investigations. The latter include the need for the introduction of filters to improve performance, optimization of electromagnetic and mechanical parameters, finding the best working conditions in the asynchronous regime and, in synchronous regimes of higher orders, a more complete study of parametric oscillation.

S.C.Dunn

621.373.3

7697 THE EFFECT OF NOISE ON PHASE - LOCKED OSCILLATOR OPERATION. V.I.Tikhonov.
Avtomat. i Telemekh. Vol. 20, No. 9, 1188-96 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 9, 1161-8 (Sept. 1959; publ. May, 1960).

The action of external noise and inherent fluctuations on an inertialess phase-locked oscillator is considered by means of the Fokker–Planck equation. Formulae for the mean and dispersion of the synchronized-oscillator frequency are found. The analogy is established between this problem and that of synchronizing a self-excited oscillator in the presence of noise.

621.373.4

7698 PHASE-SHIFT OSCILLATOR. DESIGN FOR GIVEN HARMONIC DISTORTION. E.A.Freeman.
Electronic Technol., Vol. 37, No. 7, 276–80 (July, 1960).

To reduce the harmonic output of a phase-shift oscillator it is necessary to introduce a certain amount of limiting: this can be achieved using diodes and a circuit using this principle is described and analysed. Graphs are given to enable oscillators with specific 3rd and 5th harmonic content to be designed and an example is discussed. The frequency of oscillation is shown to be dependent only on the passive elements in the circuit. A.P.C.Thiele

621.373.4

7699 NOISE SPECTRUM OF PHASE LOCKED OSCILLATORS. M.W.P.Strandberg.
Proc. Inst. Radio Engrs, Vol. 48, No. 6(I), 1108-9 (June, 1960).

Describes an experimental investigation of the noise spectrum of a 10 Gc/s klystron, phase locked to a signal derived by multiplication from a 1 Mc/s crystal-controlled oscillator. The results indicate that the noise originating in the crystal oscillator and multiplier is negligible. In this case, the noise power was more than 100 dB below carrier per c/s. The advantages of reducing the number of stages in the multiplier are noted. E.A.Ash

621.373.4

7700 ON THE RESOLVING TIME AND FLIPPING TIME OF MAGNETORESISTIVE FLIP-FLOPS.
A.Aharoni and E.H.Frei.
Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1436-48 (Aug., 1960).

The time constant of the exponential approach to the stable states is shown to be a fair approximation for the flipping time of the "bridge" magnetoresistive flip-flop. This time-constant turns out to be at least of the order of milliseconds for the magnetoresistive materials known at present, which is too large. Similar time-constants are used as an approximation for the resolving times of a general nonlinear network, in particular networks in which the nonlinear element is a magnetoresistor. It is shown that these time-constants are the latent roots of a certain matrix whose elements can readily be calculated from the parameters of the network. The flipping time of the "bridge" magnetoresistive flip-flop is calculated as a function of the energy supplied by the incoming pulse. The calculation is made by the numerical solution of the nonlinear differential equation involved. The results show that for input pulses of conceivable amplitudes the linear time-constant is a good measure of the flipping time.

621.373.4

7701 NOISE IN OSCILLATORS. W.A.Edson.
Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1454-66 (Aug., 1960).

Noise affects the behaviour of oscillators in at least two important ways. During sustained oscillation, noise creates undesired perturbations or modulation in both the amplitude and the phase of the wave. The amplitude perturbations produce a continuous spectrum which in typical situations is quite weak and broader than the bandwidth of the resonator. The phase perturbations disperse the nominal frequency into a continuous distribution which is of the same form but much stronger and narrower than for the amplitude perturbations. During the initiation of oscillation, noise constitutes the starting voltage and therefore affects the time required for the wave to reach some pre-established amplitude. The resulting jitter in the starting time of pulsed oscillators is objectionable because it degrades the signal-to-noise ratio in systems employing super-regenerative receivers or pulse-time modulation. The time and spectral distributions of noise effects in typical oscillators are derived and discussed.

621.373.4

7702 BACKGROUND NOISE IN NONLINEAR OSCILLATORS. J.A.Mullen.
Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1467-73 (Aug., 1960).

For a general black-box model of a resistive one-terminal-pair nonlinear oscillator, it is shown that the noise output from noise bands around the oscillatory frequency is composed of an additive noise of the shape of the oscillator resonant circuit and a very small f.m. broadening of the oscillator line. A noise generator across the oscillator terminals will produce the same amount of additive noise in the load as if the nonlinearity were absent, but the upper and lower sidebands are fully correlated, not independent as in the linear case. The noise bandwidth of the additive noise can be determined by the passive elements and the change in oscillator output power with changing load conductance at the operating load conductance. When the load conductance is adjusted for maximum oscillator output power, the noise bandwidth is the same as if the value of load conductance gave maximum power from a linear circuit.

621.373.4

7703 MONOCHROMATICITY AND NOISE IN A REGENERATIVE ELECTRICAL OSCILLATOR. M.J.E.Golay.
Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1473-7 (Aug., 1960).

The regenerative oscillator is postulated to be equivalent to an RLC circuit in which a negative resistance - R_B, placed parallel with R, has a value which is a slowly varying function of the mean-square voltage across it. Expressions are derived for the departure from monochromaticity of the regenerative oscillator so represented, as well as for the intensity and bandwidth of the thermal noise generated in the oscillator by the resistance R.

621.373.4

7704 SYNCHRONIZATION STABILITY UNDER THE INFLUENCE OF MODULATED SIGNALS ON AN OSCILLATOR. Yu.I.Samoilenko.
Radiotekhnika, Vol. 15, No. 7, 37-41 (July, 1960). In Russian.

Based on previously published work by Martynenko and Khophlov (Abstr. 312 of 1959), an extended analysis of locking processes of oscillators is presented. The basic differential equations are quoted in terms of phase displacement, external signal modulation depth (a.m.) or deviation (f.m.) and frequency difference between applied signal and free frequency of the oscillator. An auxiliary theorem is proposed, which enables a rapid solution of relevant equations to be obtained in terms of above parameters. The generalized interpretation indicates that in the case of the external signal being modulated stable synchronization is possible even if the instantaneous frequency of the impressed signal is momentarily beyond the locking range observed for an unmodulated carrier, the locking range growing with modulation frequency but decreasing with growing amplitude modulation depth. For the case of steadily increasing deviation of the external f.m. signal, stable and unstable locking zones alternate, due to complex phase conditions. A.Landman

621.373.4

7705 THE SELECTIVE PROPERTIES OF AN OSCILLATORY SYSTEM SYNCHRONIZED WITH A HARMONIC SIGNAL. Yu.I.Samoilenko.
Radiotekhnika i Elektronika, Vol. 4, No. 1, 39-42 (Jan., 1959). In Russian.

A theoretical investigation is made of the variations of the amplitude and phase of an oscillator synchronized with a harmonic signal in the presence of quasi-harmonic interference and noise, assuming the variations to be small. The conditions for reducing the effect of the interference are derived. R.C.Glass

621.373.421

7706 FEEDBACK STABILIZES SIGNAL GENERATOR. A.Fong.
Electronics, Vol. 33, No. 29, 71-3 (July 15, 1960).

A single channel negative feedback system in which both carrier level and modulation can be detected and compared with the original modulation voltages to less than ±0.5 dB over a 3 to 1 range in frequency and less than ±1 dB over a 1300 to 1 range in frequency. Modulation fidelity is less than 1% distortion at 30% index for modulation frequencies from 0 to 15 kc/s. The detection process in the feedback loop removes the carrier and provides a d.c. component proportional to the average peak carrier. The detector also provides an audio voltage which is a replica of the modulating wave. This composite signal is compared in a differential amplifier with the original modulating signal. A block diagram and circuits are given, also a description of the special design features. B.B.Austin

621.373.421

7707 THE EFFECT OF μ-CIRCUIT NON-LINEARITY ON THE AMPLITUDE STABILITY OF RC OSCILLATORS. B.M.Oliver.
Hewlett-Packard J., Vol. 11, No. 8-10, 8 pp. (April-June, 1960).

Many analyses have been made of the power-sensitive feedback-controlling mechanism of RC oscillators which regulates the level of oscillation. These analyses all assume perfect linearity in the amplifier circuit; however the envelope stability is usually much better than this linear theory predicts. In the analysis presented,

account is taken of the small non-linearity which exists in the amplifier portion of the oscillator. Simple lamp-stabilized oscillators depend in large measure for their dynamic amplitude stability upon this non-linearity. The theory was verified by setting up an oscillator and producing a small transient by shorting a small resistance in series with the lamp feedback circuit. It was shown that the envelope transient was more oscillatory in all cases when the amplifier distortion was low. Loop gain characteristics and oscillograms are given. B.B.Austin

621.373.421.13

7708 CALCULATION OF AN ELECTRICAL EQUIVALENT CIRCUIT OF THE LOADED BAR-TYPE MAGNETOSTRICTIVE TRANSDUCER. R.Suwalski.
Arch. elektrotech. (Warsaw), Vol. 7, No. 4, 647-67 (1958). In Polish.

A long slotted bar is considered, made of a magneto-strictive material. The coil is wound through the slot, and it is assumed that the length of magnetic path equals twice the length of the bar. Using distributed constants for the bar material the fundamental wave equations are derived and transformed into an expression for the mechanical impedance. A practical approximation is given for the normal (near resonant) mode of operation. An experimental verification of the formulae is carried out, preceded by measurments of some of the coefficients of the material used. Results are compared for a laminated nickel-bar transducer with both ends free, or with one or both ends loaded by water. Eleven references. Z.A.A.Krajewski

621.373.421.13

7709 RADIATION EFFECTS ON QUARTZ OSCILLATORS. O.Renius and D.Rees.
Proc. Inst. Radio Engineers, Vol. 48, No. 7, 1340 (July, 1960).

The frequency shift of quartz oscillators with respect to total dose received, dose rate, and the level of X- and gamma-ray incident energy is discussed. Measurements were made using BT-cut crystals with a fundamental frequency of 10 Mc/s. It was found that the frequency changed exponentially with dose and tended to saturate at about 10^6r. No frequency changes have yet been found which can be totally attributed to a change in dose rate. The frequency shift however increased in direct proportion to the peak energy of the incident radiation at a dose level of 3×10^5r. A.P.C.Thiele

621.373.43 : 621.397.621

7710 A NEW VERTICAL TIME BASE [FOR TELEVISION RECEIVERS]. E.M.Cherry.
Proc. Instn Radio Engrs Australia, Vol. 21, No. 6, 387-93 (June, 1960).

A description and detailed analysis of a new circuit for the vertical time base in television receivers. The circuit, which requires no close tolerance, undesirable values, or special components, has several advantages over present time bases: (1) it is almost completely independent of tube characteristics; (2) it is almost independent of mains voltage fluctuations; (3) the flyback voltage pulse is rectangular, and hence is of as small an amplitude as possible; (4) there is no interaction between any of the controls. These characteristics are obtained by the use of a high gain negative-feedback loop.

621.373.43

7711 SPECTRUM OF THE OUTPUT SIGNAL OF A RANDOM NOISE GENERATOR. L.Prouza.
Slaboproudy Obzor, Vol. 21, No. 9, 527-8 (1960). In Czech.

The noise signal is formed as follows. First, a train of narrow pulses spaced at distances T and having peak amplitudes of +V and −V is produced, the probabilities of +V and −V being $\frac{1}{2}$. Each pulse is then lengthened into a rectangular pulse having a duration $\tau_0 = \gamma T$, where $0 < \gamma < 1$. The resulting signal is applied to a linear filter. It is shown that the spectrum of the signal at the output of the filter is:

$$S(\omega) = 2V^2(1 - \cos \tau_0\omega) \left|Y(j\omega)\right|^2/T\omega^2$$

where $Y(j\omega)$ is the transfer function of the filter. When $\tau_0\omega \ll 1$, the formula can be simplified since $(1 - \cos \tau_0\omega) = \frac{1}{2}\tau_0^2\omega^2$. R.S.Sidorowicz

621.373.431

7712 VIBRATORS. I. G.Siewert.
Elektronik, Vol. 9, No. 5, 145-6 (May, 1960). In German.

The author criticizes the varied nomenclature for non-sinusoidal oscillators and proposes the following terms; multivibrator (MuV), a free-running circuit with two metastable states; monovibrator (MoV), monostable flip-flop; bivibrator (BiV), a circuit with two stable states, requiring two trigger pulses to bring it back to the initial state. The various arrangements of the MuV are reviewed, including some special types developed by the author. W.G.Stripp

621.373.431

7713 VIBRATORS. II. G.Siewert.
Elektronik, Vol. 9, No. 6, 183-5 (June, 1960). In German.

For Part 1 see preceding abstr. A number of MoV and BiV circuits are discussed and suggestions made for clearer diagrammatic representation. W.G.Stripp

621.373.431.1

7714 DESCRIPTION OF THE TRANSITION PROCESS IN A MULTIVIBRATOR. G.Kohn.
Arch. elekt. Übertragung, Vol. 14, No. 5, 193-203 (May, 1960). In German.

A bistable circuit is divided into a quadripole containing all nonlinear but no energy storing elements, and the two energy storing capacitors; their voltages are taken as coordinates in the mathematical analysis. Differential equations for the time functions of the above voltages are intercoupled by two nonlinear functions which can be interpreted as the static transfer-characteristics of the quadripole; they can be easily measured. Lines of state are constructed along which the pair of capacitor voltages move, beginning at any point; a complete family of these lines of state gives a full representation of all processes possible in the circuit. Triggering of the change-over of the bistable circuit is described and the influence of duration and amplitude of the trigger pulse on the duration of the change-over is discussed. A graphical method for determining the stability of the circuit is explained. Optimum anode-resistance is calculated for multivibrators with the shortest possible change-over period. J.M.Silberstein

621.373.431.1

7715 FREQUENCY CONTROL AND FREQUENCY VARIATIONS OF AN ASTABLE MULTIVIBRATOR. G.Linckelmann.
Arch. elekt. Übertragung, Vol. 14, No. 7, 299-313 (July, 1960). In German.

A multivibrator circuit containing parallel RC circuits directly at the grids of both valves is analysed with respect to frequency control and frequency variations. The circuit has a better pulse rise-time and a wider range of frequency control by means of grid bias voltage than the conventional multivibrator. The range of the frequency control is calculated and results are compared with measurements. As the frequency is strongly dependent on the voltage, all voltage irregularities are of great importance: these can be caused by an interference voltage of a certain frequency or by wide-band effects, e.g. valve noise. The influence of various types of voltage variations is studied. Period distribution was measured by means of a frequency–time measuring instrument and the results are shown for various grid voltages. Three examples of multivibrator design are given. J.M.Silberstein

621.373.431.1 : 621.382.3

7716 NEGATIVE RESISTANCE OF STORAGE ELEMENTS BASED ON JUNCTION TRANSISTORS. V.Špány.
Slaboproudy Obzor, Vol. 21, No. 7, 403-8 (1960). In Slovak.

Four types of transistorized bistable circuits are considered: (1) the classical symmetrical binary pair; (2) an emitter-coupled circuit; (3) a collector-coupled complementary circuit; and (4) an emitter-coupled complementary pair. The negative resistance characteristics of the circuits at two relevant points were investigated experimentally and the results are illustrated in 19 oscillograms. It was found that the characteristics have either N- or S-shape. All the bistable circuits can be modified so as to obtain an astable relaxator. Two special multivibrator circuits are suggested. It is shown that the negative-resistance properties of the bistable circuits can be used as sensitive voltage discriminators or as temperature-sensitive warning devices. R.S.Sidorowicz

621.373.431.1

7717 A PLUG-IN TRANSISTORIZED FLIP-FLOP CIRCUIT WITH READ-OUT BY MEANS OF NEON INDICATORS. J.Havel.

Slaboproudy Obzor, Vol. 21, No. 7, 409-12 (1960). In Czech.

The design of a standard flip-flop based on two junction transistors is described in detail and two methods of forming a decade from four flip-flops are indicated. A method of indicating the state of a given transistor by means of a miniature neon tube (indicator) is proposed. One terminal of the indicator is connected to a d.c. source whose voltage is lower than the striking potential V_s of the tube. The other terminal is connected to the collector of the transistor through a high-resistance potentiometer. The indicator is paralleled by a suitable capacitor, so that it can operate as a relaxation oscillator when the voltage across it exceeds V_s. The voltages for individual tubes are set by the potentiometers. In practice a flip-flop output voltage of 10 V is sufficient to ensure a reliable operation of the indicators. R.S.Sidorowicz

621.373.431.1

7718 FUNDAMENTAL CONSIDERATIONS OF POWER DISSIPATION LIMITS IN SOME BISTABLE TRANSISTOR PULSE CIRCUITS. H.Raillard.

Trans Amer. Inst. Elect. Engrs III, Vol. 79, 53-5 (1960) = Commun. and Electronics, No. 47 (March, 1960).

The maximum frequency of operation of a flip-flop circuit (emitter coupled or base-return type) is influenced by cross-coupling elements (R_k and C_k) and it is limited as follows: (a) at low power levels mainly (below 0.5 mW) by current amplification of the transistor; (b) at medium power, (0.5 mW to 80 mW) by collector capacitance and load impedance product; and (c) at high power, by the gain–bandwidth product only. Other significant parameters including output power requirements, stability and temperature variations are not considered here. A.Sczaniecki

621.373.431.2

7719 MILLIMICROSECOND BLOCKING OSCILLATOR. Yu.P.Mel'nikov and S.Ya.Shats.

Radiotekhnika, Vol. 15, No. 6, 36-44 (June, 1960). In Russian.

The circuit is a conventional one and the analysis is carried out by means of a piecewise-linear approximation. The characteristics require the solving of two simultaneous non-linear equations which relate anode current and the electrode voltages and grid current and the electrode voltages. The essential feature of this method is that the parasitic elements are used in the course of design. Two examples are given of the application of the method to circuits providing pulses with rise times to the order of 30×10^{-9} sec. Experimental results establish that the error in the predicted performance does not exceed 20%. S.C.Dunn

621.373.44

7720 A PULSE GENERATOR BASED ON A ROSENBLUM COUNTER. J.Fleury.

Nuclear Electronics Conference, Paris, 1958, Vol. I.(see Abstr. 4975 of 1960) p. 259-62. In French.

The pulses are produced by discharge between one or more wires, at 3.2 kV, and a metal plate which is earthed through an RC potential divider. The discharge is initiated by the passage of a particle close to a wire. Half-amplitude pulse widths of 5×10^{-9} sec., with rise time 2.5×10^{-9} sec. and amplitude variable between 1 V and 45 V are obtained. The load impedance can be reduced to 2Ω. W.G.Stripp

621.373.44

7721 PULSE GENERATOR FOR SYNCHRONIZING EVENTS. R.E.Daniels and C.Swobada.

Electronics, Vol. 33, No. 24, 63 (June 10, 1960).

The circuit and operation of the timing pulse generator for a large synchrontron is described. E.A.Ash

621.373.44 : 621.391.812.61

7722 SEA-GOING LIGHTNING GENERATOR. M.M.Newman, J.R.Stahmann, J.D.Robb and E.A.Lewis.

Electronics, Vol. 33, No. 30, 53-5 (July 22, 1960).

Details are given of schooner-borne equipment used with a 10 000 ft helicopter-supported aerial to produce high-power l.f. pulses similar to lightning atmospherics. The megavolt generator used produces in the aerial a peak output power of about 30 MW, the calculated field strength of a 20 kc/s pulse being about 20 mV/m at a distance of 1000 km from the aerial. The generator can be triggered manually or from a time standard which is synchronized with WWV signals. A block diagram shows the general arrangement of the transmitting and receiving equipments used. Some circuit details are also given of the transmitter and of the phase shifter used for synchronizing the crystal-controlled frequency standard with the WWV signals. The equipment affords a means for studying l.f. propagation over long distances, with possible practical applications in the fields of long-range communication and navigation. The use of inverted-L or semicircular aerials for generating "whistlers" is suggested. A.Wilkinson

621.373.44

7723 GENERATOR DELIVERS CONSTANT CURRENT OR VOLTAGE PULSES. L.A.Rosenthal.

Electronics, Vol. 33, No. 38, 82-4 (Sept. 16, 1960).

The circuit described, providing a means for testing and evaluating electroexplosive devices, consists basically of a thyratron generating half-sine waves followed by a transistor for pulse shaping and an output transistor as a linear pulse amplifier. Output is a constant current or constant voltage pulse of amplitude 0 to 10 V or 0 to 10 A. Pulse width is variable between 100 and 1000 microsec. In constant voltage and constant current mode the internal resistances are 0.1 ohm and 295 ohm respectively. A complete circuit diagram and description of circuit action is also given. M.Goldberg

621.373.44

7724 ON THE DEVELOPMENT, CONSTRUCTION AND USE OF A DOUBLE PULSE GENERATOR. G.Stasche.

Elektronik, Vol. 9, No. 5, 133-41 (May, 1960). In German.

The generator is designed to deliver pairs of pulses at a p.r.f. of 100, 300, or 1000 c/s, with rise times of 0.1 to 0.2 μs, durations variable from 0.5 μs to 150 μs and separations from 1 μs to 250 μs, and amplitude variable up to 50 V. A phase-shift oscillator is used to synchronize two rectangular wave generators, the second starting after a delay introduced by a variable-duration monovibrator. The two pulses are mixed in a double triode with common cathodes. A circuit diagram is given and applications to transistor testing are described. W.G.Stripp

621.373.44

7725 THE CHOICE OF OPTIMAL STATIC PARAMETERS OF A TRIGGER CIRCUIT.

B.N.Faizulaev and V.I.Yanushkevich.

Radiotekhnika, Vol. 15, No. 7, 60-6 (July, 1960). In Russian.

A typical trigger circuit with two pentodes is analysed with the aim of obtaining: (1) maximum tolerance of voltages and components at a given speed of operation; and (2) maximum speed at a given tolerance of voltages and components. Recommendations are given for the choice of valves for a trigger. A.Woroncow

621.373.44 : 538.1

7726 AN ARRANGEMENT FOR PRODUCING PULSED, STEADY AND STRONG MAGNETIC FIELDS. J.Durant, O.Klüber and H.Wulff.

Z. angew. Phys., Vol. 12, No. 9, 393-5 (Sept., 1960). In German.

It is first shown how a length of artificial line may be used to produce short pulses of current. The termination of the line in an exciting winding of an electromagnet enables a pulsed magnetic field to be produced, provided the inductance of the winding is less than one half of the inductance of the artificial line per unit section. It is then shown that if a reasonable number of sections are used in the line to produce a pulse of satisfactory shape the energy in the field is only a small fraction of the total energy fed into the line. The efficiency of the system is much improved if the switching to the line is carried out in two stages and an auxiliary capacitor is used in such a way that switching occurs when the time derivative of current is zero. A practical circuit is given which will produce a field of 50 kG for 2 msec in a volume of 30 cm^3. S.C.Dunn

621.373.5

7727 TRANSISTOR BETA-PHASE-SHIFT OSCILLATOR. A.R.Saha.

J. Electronics and Control, Vol. 9, No. 2, 113-25 (Aug., 1960).

A new junction-transistor oscillator circuit is described. It makes use of the internal phase-shift of a transistor and only a single C-R section as the external phase-shifting network — advantage being taken of the low-input impedance of a common emitter junction transistor. Analytic expressions for the frequency of oscillation and minimum voltage feedback factor for sustained oscillations have been deduced. Calculated values of frequency and minimum voltage feedback factor are shown to compare favourably with the experimental values. A range of oscillation frequency extending to several times the cut-off value of the transistor is shown to be obtainable.

621.373.5

7728 SOLID-STATE MICROWAVE POWER SOURCES USING HARMONIC GENERATION. R.Lowell and M.J.Kiss.
Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1334-5 (July, 1960).

The circuit is briefly described and consists of a single silicon transistor oscillator operating at 218 Mc/s with an output of 1.5 to 2.0 W feeding two silicon diffused varactor diodes behaving as harmonic generators. The first stage is a high-breakdown moderate-Q diode (C_o = 5.3 $\mu\mu$F, R_s = 1.2 ohms, V_b = −39 V) and operates in the 5th harmonic giving a maximum output of 200 mW at 1090 Mc/s. The final stage uses a high-Q low-breakdown-type diode (C_o = = 1.2 $\mu\mu$F, R_s = 1.8 ohms, V_b = −6 V) and operates in the 8th harmonic giving an output of 2 mW at 8720 Mc/s. For the 5th-harmonic generator the input resistance is shown to be very dependent on the crystal bias voltage and a major problem is matching into this rapidly varying input impedance. A.P.C.Thiele

621.373.5 : 621.382.2

7729 U.H.F. HARMONIC GENERATION WITH SILICON DIODES. D.Leenov and J.W.Rood.
Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1335 (July, 1960).

The use of silicon diffused-junction diodes with high breakdown voltages has resulted in large increases in harmonic power output along with higher efficiences. One harmonic generator has delivered 1.1 W of 2nd harmonic power at 800 Mc/s with an efficiency of 48%, another gave 166 mW of 4th harmonic at 1600 Mc/s with a 17% efficiency. Finally 2 mW at X band has been obtained with 0.6% efficiency by multiplying an 1800 Mc/s input. To investigate the relation between breakdown voltage and power handling ability diodes with 7 and 41 volt breakdowns were compared. For the 7 V diode the output saturated at 10 mW while for the 41 V diode it saturated at 1.1 W. A simple calculation suggests that saturation occurs when the fundamental voltage amplitude becomes large enough to drive the diode into forward conduction beyond reverse breakdown, resulting in greater losses. A.P.C.Thiele

621.373.5

7730 NONLINEAR ANALYSIS OF A TRANSISTOR HARMONIC OSCILLATOR. D.O.Pederson and R.S.Pepper.
Proc. Nat. Electronics Conf., Vol. 15, 536-45 (1959).

With vacuum-tube harmonic oscillators, e.g., a tuned-plate oscillator, nonlinear phase-plane analysis usually does not provide a close prediction of actual oscillator performance. This is in part due to the difficulty of obtaining a valid nonlinear V−I characteristic that is presented to the tank circuit. In addition, the second-order approximation for the characteristic equation of the system is often poor. Both of these problems are less severe in working with transistors. For a representative transistor oscillator, e.g., a tuned-collector oscillator, both graphical and piece-wise linear techniques are developed for obtaining the composite negative resistance characteristic that is presented to the tank circuit. This is done for the common-emitter connection of the transistor; however, the common-base connection can also be used. With the negative resistance characteristic, conventional phase-plane and limit-cycle analysis can be used to predict the oscillator output. Higher order effects are inspected, and it is found that the simplifying assumptions made are quite valid. Thus, the second-order differential equation provides a good approximation of the system. Experimental results show that predicted and observed values are within a few percent for amplitude of oscillation, period of oscillation, and wave shape, i.e., harmonic content.

621.373.51

7731 TUNNEL-DIODE MICROWAVE OSCILLATORS WITH MILLIWATT POWER OUTPUTS.
D.E.Nelson and F.Sterzer.
I.R.E. WESCON Convention Record, Vol. 4, Pt 1, 68-73 (1960).

Several experimental tunnel-diode r.f. oscillators which operate at frequencies from 300 to 8000 Mc/s are described. Power outputs of several milliwatts have been obtained at frequencies below 1000 Mc/s, 0.7 mW at 2800 Mc/s, 0.2 mW at 5500 Mc/s and 0.01 mW at 7130 Mc/s. Problems relating to oscillation frequency and oscillation build-up are treated analytically.

621.373.51

7732 VOLTAGE TUNING IN TUNNEL DIODE OSCILLATORS. J.K.Pulfer.
Proc. Inst. Radio Engrs, Vol. 48, No. 6(I), 1155 (June, 1960).

An Esaki diode connected at one end of a low impedance coaxial line together with a variable supply source has been used to produce a frequency variable oscillator using the bias circuit to control the frequency. Power output was −30 dBm and the coaxial line impedance 20 ohms, diode negative resistance 25 ohms. Tuning ranges of up to 12% at 1500 Mc/s are claimed. It is suggested that mechanical tuning could result in a ±15% change in frequency. J.MacCormack

621.373.51

7733 A PARAMETRIC SUBHARMONIC OSCILLATOR PUMPED AT 34.3 kMc/s. A.H.Solomon and F.Sterzer.
Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1322-3 (July, 1960).

Describes an oscillator using a variable capacitance diode, specially packaged to have a cutoff frequency of the order of 150 Gc/s and a capacity of a fraction of a pF. The diode is mounted across a ridged waveguide and with less than 4 mW pump power, oscillations at 17.15 Gc/s are observed, the device giving a conversion efficiency of approx. 7%. G.D.Sims

621.373.52 : 621.374.42

7734 A TRANSISTORIZED CRYSTAL CHRONOMETER. N.F.Blackburne and R.A.Spears.
A.T.E. J., Vol. 15, No. 4, 303-12 (Oct., 1959).

The instrument uses a 4096 c/s crystal-controlled oscillator and 18 binary dividers. The master chronometer has dial indication, with pulse outputs for slave devices. Facilities are provided for stopping or advancing the master and slave clocks, and these always read exactly alike. The accuracy is within 0.5 s per week. W.G.Stripp

621.373.52

7735 SPACE CAPSULE OSCILLATOR. N.Kling.
Electronics, Vol. 33, No. 38, 66 (Sept. 16, 1960).

Describes an audio push-pull transformer-coupled transistor oscillator designed for minimum power supply, which develops an almost constant 50 mW clipped output with a power supply variation from 18 to 30 V. The encapsulated circuit withstands severe environmental conditions. D.J.Truslove

621.373.52 : 621.314.58

7736 TRANSISTOR D.C. CONVERTER WITH BUILT-IN MAGNETIC STABILIZATION. M.E.Poyurovskii.
Elektrichestvo, 1960, No. 5, 66-70 (May). In Russian.

An analysis of transistor d.c. converter operation of conventional design is made first, and formulae are derived for collector current and potential, magnetic flux and operating frequency in terms of physical dimensions and electromagnetic data of the transformer. The stabilized circuit is then described, consisting in an application of negative feedback by obtaining a rectified current proportional to output voltage and passing it through a saturated diode so as to demagnetize same. I_c, fed via symmetrical windings of the choke, normally maintains saturation; with output voltage rising, the working point shifts from the horizontal portion of the hysteresis loop, the choke takes control and reduces the voltage in the transformer primary. A quantitative analysis of the stabilization process and sensitivity is given in terms of maximum I_c, load and output voltage. Operating frequency is also stabilized, because transistors are switched during transformer saturation, and $f \cong$ output voltage. The design of an optimal transformer is then undertaken, and it is shown that stabilization efficiency is independent of voltage waveform; it does therefore also apply in the case of a capacitive output filter. A.Landman

621.373.521

7737 TRANSISTORIZED WIEN BRIDGE OSCILLATOR. F.Butler.
Wireless Wld, Vol. 66, No. 8, 386-90 (Aug., 1960).

The oscillator covers 20 c/s to 20 kc/s in three ranges. To obtain a high input impedance to the maintaining amplifier, a super-alpha pair is used, in which the base current of the second transistor is the emitter current of the first and the collectors have a common load. Tuning is by ganged variable resistors and two thermistors are used for amplitude stabilization. W.G.Stripp

621.373.531.1

7738 ANALYSIS OF ROYER MULTIVIBRATOR OPERATION IN INDUSTRIAL TELEMETRY DEVICES. A.M.Pshenichnikov.
Avtomat. i Telemekh., Vol. 20, No. 9, 1250-61 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 9, 1219-29 (Sept., 1959; publ. May, 1960).

For details of the Royer circuit, see Abstr. 4618 of 1955.

The conditions are investigated under which multivibrator oscillations are generated, the frequency of these oscillations being determined by the magnetic polarity reversal-time of the core. The functional dependencies of the circuit output frequency and voltage and its power requirements on the input voltage, the circuit parameters and the core material and transistor characteristics are determined.

621.373.531.4

7739 THE STARTING CONDITIONS OF AVALANCHE PROCESSES IN RELAXATION OSCILLATORS USING POINT-CONTACT TRANSISTORS. V.N.Yakovlev.
Radiotekhnika i Elektronika, Vol. 4, No. 1, 70-4 (Jan., 1959). In Russian.

It is shown that relaxation oscillators using point-contact transistors may be considered as devices containing non-linear voltage or current amplifiers. The starting conditions of avalanche processes are derived. In the case of capacitive relaxation oscillators the condition is that the voltage amplification factor should be greater than one and for inductive orcillators the condition is that the current amplification factor should be greater than one. [English summary: PB 141106T-12, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.]. R.C.Glass

621.373.54

7740 A CASCODE TRIGGER CIRCUIT USING A PNP AND NPN TRANSISTOR. P.Arnoldt.
Electronic Engng, Vol. 32, 620-3 (Oct., 1960).

A monostable trigger circuit employing a p-n-p and an n-p-n transistor in a cascade arrangement is described. The circuit when preceded by a diode pump integrator forms a frequency dividing stage. Optimum conditions to ensure the safest operation with temperature variations are derived. Practical values for a stage reliably dividing by 10 over a temperature range of 5° to 50°C with input pulses of 100 kc/s are given. The output pulse of such a stage is suitable for driving the input of a subsequent stage. The trigger circuit can also be employed to generate sawtooth waveforms or operate as a time modulator.

621.373.54 : 621.397.62

7741 LINEARIZATION OF A TRANSISTORIZED VERTICAL DEFLECTION SYSTEM. R.B.Ashley.
I.R.E. Trans Broadcast and Televis. Receivers, Vol. BTR-6, No. 1, 39-48 (May, 1960).

In such a system non-linearity is caused by the transfer characteristics of the drive from the sawtooth generator to the output transistor (network N1), the output transistor itself and the output coupling network to the deflection yoke. In order to minimize non-linearity it is desirable: (1) to employ output transistors with a high and uniform beta characteristic; (2) to utilize the linearizing characteristic of emitter degeneration and low base-bias network impedance; (3) to employ a large choke–yoke inductance ratio in the output network; and (4) to use a low output impedance in the sawtooth generator and network N1. A favourable design of the network N1 is evolved. H.G.M.Spratt

PULSE CIRCUITS . DIGITAL CIRCUITS SWITCHING CIRCUITS

621.374

7742 REVIEW OF SOME RECENT CONTRIBUTIONS TO PULSE TECHNIQUES IN THE FIELD OF CLASSIC NUCLEAR ELECTRONICS. E.Gatti.
Nuclear Electronics Conference, Paris, 1958, Vol. I (see Abstr. 4975 of 1960) p. 273-80.

621.374.3

7743 A BOOTSTRAP INTEGRATOR. F.K.Altenhein
Regelungstechnik, Vol. 7, No 7, 234-9, (July, 1959). In German.

The basic integrator circuit using capacitance and resistance is described. From this is derived the Miller integrator, with its high gain d.c. amplifier. The bootstrap integrator, which uses a d.c. amplifier of unity gain, is introduced, and the importance of amplifier linearity stressed. A bootstrap integrator which incorporates a newly developed two-valve cathode-follower amplifier is then described. It is shown that the integrating accuracy can be improved by the addition of a current stabilizing circuit of similar design to the amplifier. A final complete circuit is discussed, and details of measurements are given. For amplifier outputs in the range ± 10 volts, with load resistances of over 200 kΩ, the maximum deviation from linearity is one part in 10^5. Short term and long term drift are each less than 0.5 mV. For frequencies up to 2.5 kc/s, the relative phase error is less than 1°, and the relative amplitude error still smaller. D.J.Bailey

621.374.3

7744 THE METHOD OF INTERPOLATION OF FUNCTIONS BY EXPONENTIAL POLYNOMIALS, AND ITS APPLICATION TO THE SYNTHESIS OF ELECTRICAL CIRCUITS WITH GIVEN TIME CHARACTERISTICS. N.S.Kochanov.
Radiotekhnika, Vol. 15, No. 8, 61-6 (Aug., 1960). In Russian.

Starts from the 2n tabulated values of a function of time t at equidistant values of t and seeks to represent it in the form

$$\phi(t) = \sum_{k=1}^{n} C_k e^{P_k t}.$$

This leads to a system of algebraic equations (instead of transcendental equations as in the general case of nonequidistant base points), whence the coefficients are easily obtained. The method is further simplified if tabulated values of the first derivative $\phi'(t)$ are given. A practical illustration relates to the design of a four-terminal network for obtaining a bell-shaped pulse $F(t) = \sin^2 \pi \frac{t}{T}$ for $0 \leq t \leq T$, = = 0 for $t > T$. D.E.Brown

621.374.3

7745 EFFECTS OF RESISTANCE IN AVALANCHE TRANSISTOR PULSE CIRCUITS. D.J.Hamilton.
Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1502 (Aug., 1960).

By making several simplifying assumptions, expressions are obtained for the decrease in peak current and the increase in rise-time due to the series resistance R in the output circuit, where R includes both the load and the internal series resistances in the transistor. Experimental data agrees satisfactorily with predictions. F.F.Roberts

621.374.3

7746 A CONTRIBUTION TO THE MATHEMATICAL EXPRESSION OF PULSE NETWORKS. R.Hofmann.
Arch. elekt. Übertragung, Vol. 14, No. 6, 255-61 (June, 1960). In German.

Pulse circuits are defined as consisting of a linear circuit and a pulse element which converts a continuous input into a series of equidistant pulses with amplitudes proportional to the input. Series of pulses of any shape are considered. The method of discrete Laplace transformation based on staircase functions is used to make theory and design methods of pulse networks similar to those of the other networks. The equation of pulse networks which is derived is applicable also to closed systems, e.g. automatic control and feedback. The method is illustrated by calculating some practical cases. J.M.Silberstein

621.374.3

7747 A MILLIMICROSECOND PULSE-SHAPING CIRCUIT. P.R.Orman and F.H.Wells.
Nuclear Instrum., Vol. 1, No. 4, 183-5 (July, 1957).

A pulse-shaping circuit is described which sharpens the output pulses from a secondary-emission pulse generator, to produce negative pulses of one millimicrosecond rise-time and of seven volts amplitude at an output impedance of seventy ohms. The circuit is capable of being driven at a repetition frequency of 50 kc/s.

621.374.3

7748 PULSE-LENGTHENER CIRCUITS. M.A.Meyer.
Nuclear Instrum., Vol. 1, No. 2, 62-5 (March, 1957).

Existing and new circuits are discussed which convert pulses of short duration proportionally into flat-topped pulses of which the duration varies from a few tenths of a microsecond to several seconds.

621.374.3 : 539.1.07

7749 A COINCIDENCE CIRCUIT WITH A SHORT RESOLUTION TIME AND A HIGH COUNTING RATE. J.C.Brisson, G.Valladas and R.van Zurk.
Nuclear Electronics Conference, Paris, 1958. Vol. I. (see Abstr. 4975 of 1960), p. 233-41. In French.

Particles are detected by n scintillators placed on their trajectories. The photomultiplier pulses are standardized to V volts and added in a distributed amplifier. The sum pulse is applied to an amplitude discriminator with a threshold between nV and (n-1)V. The resolution time is about 4×10^{-9} sec and counting rate about 3×10^{4} coincidences per second. W.G.Stripp

621.374.3 : 621.387.4 : 539.12

7750 CONSTRUCTION OF A CHRONOTRON FOR A FAST NEUTRON SPECTROMETER. J.Duclos.

Nuclear Electronics Conference, Paris, 1958. Vol. I. (see Abstr. 4975 of 1960), p. 243-7. In French.

The source of neutrons is a tritium target, bombarded by deuterons from a 300 kV accelerator, giving rise to the simultaneous emission of a neutron, and an α particle. The instant of emission is determined by detecting the α particle. The coincidence circuit is an improvement of one due to O'Neill, in which the pulses are applied to two delay lines, between which are connected at regular intervals the two control grids of ten 6BN6 valves. The delay between the two pulses is determined approximately by the valve which produces the largest pulse. An interpolating circuit has been added in which the anodes of the valves are connected to points on a slow delay line. The current pulses charge the line in such a way that it carries an envelope pulse with a maximum at the point of coincidence. This maximum is detected at the end of the line and its time of arrival gives the delay between the two input pulses. For standard pulses, a time resolution less than 10^{-10} is claimed, but as the input pulse amplitude varies the distribution curve is shifted along the time axis. Nevertheless, for variations between 3 and 7V, the resolution is 2.2×10^{-10}. W.G.Stripp

621.374.3 : 539.1.07 : 529

7751 HIGH SPEED COUNTER CHRONOMETER. A.M.Hillas and R.M.Tennent.

Nuclear Instrum., Vol. 3, No. 6, 344-9 (Dec., 1958).

A counter chronometer is described which measures time invervals up to 12.75 microseconds by counting the oscillations of a 20 Mc/s free-running oscillator with a scaler. Provision is made for resetting the scaler by a fast pulse if the measurement is not to be recorded. The scaler is based on conventional pentodes and germanium diodes, the high counting speed being attained by limiting voltage changes.

621.374.3

7752 AN AMPLITUDE SELECTOR WITH SHORT RESOLVING TIME. M.Fiehrer and A.Pages.

Nuclear Electronics Conference, Paris, 1958, Vol. I. (see Abstr. 4975 of 1960) p. 249-58. In French.

The pulse to be analysed is applied simultaneously to 11 discriminators with adjustable thresholds. As each threshold is crossed, a signal triggers a flip-flop connected to the discriminator, and after the input pulse reaches its maximum another signal resets all the flip-flops which have previously changed their state. Anti-coincidence gates (A-C) are connected between successive pairs of flip-flops. An output pulse is produced only in the A-C corresponding to the interval containing the peak of the input pulse. The time resolution is 5×10^{-7} sec. W.G.Stripp

631.374.3

7753 DIFFERENTIAL COINCIDENCE CIRCUIT. R.Meunier.

Nuclear Electronics Conference, Paris, 1958, Vol. I.(see Abstr. 4975 of 1960) p. 263-8. In French.

Pulses from two photomultipliers (P.M.) are applied to opposite ends of a delay line, with taps at the centre (B) and on either side (A and C). The pulse from P.M.A. is taken from the anode, that from P.M.B. from a dynode. Two difference amplifiers give outputs A-B and C-B which are applied to a conventional coincidence gate. The input pulses may be of different amplitudes, and are defined by their centres of gravity. The time resolution is of the order 10^{-9} sec. W.G.Stripp

621.374.32 : 539.1.07

7754 A THREE-DIODE FAST COINCIDENCE CIRCUIT. R.Meunier and J.Teiger.

Nuclear Instrum. and Methods, Vol. 5, No. 3, 148-51 (Sept., 1959). In French.

A differential coincidence circuit is described which has an effective resolving time <1 m μs. The principle consists of having two pulses travelling in opposite directions through the same coaxial cable, and they meet at a given point. The circuit is very simple. It has been built for use on experiments with high energy accelerators.

621.374.3 : 621.317.755 : 539.1.07

PULSE SAMPLING OSCILLOSCOPE. See Abstr. 7513

621.374.32 : 539.1.07

7755 A TRANSISTOR CIRCUIT FOR FAST COINCIDENCE MEASUREMENTS. G.B.B.Chaplin and C.J.N.Candy.

Nuclear Instrum. and Methods, Vol. 5, No. 4, 242-6 (Oct., 1959).

A coincidence circuit is described which has a short resolving time (< 5 mμsec), and a high rejection of non-coincident pulses; coincident one-volt pulses trigger the circuit while single 40 V pulses do not. Use is made of germanium diodes and transistors, and pulse shaping is accomplished by means of small inductances. The resulting circuit is sensitive, compact, and consumes little power.

621.374.32 : 539.1.07

7756 A FAST COINCIDENCE CIRCUIT. D.H.White and G.W.Hutchinson.

Nuclear Instrum., Vol. 1, No. 6, 331-4 (Dec., 1957).

A coincidence circuit is described with an improved rejection ratio to non-coincident pulses. In the coincident condition, information is gathered during a large part of the time of overlap of the applied signals, not merely from the coincidence of the leading edges. The resolving time is comparable with that obtained using conventional circuits.

621.374.32 : 539.1.07

7757 A NEW METHOD FOR TIMING SCINTILLATION PULSES. F.T.Arrechi, E.Gatti and E.Zaglio.

Nuovo Cimento, Vol. 16, No. 1, 198-201 (April 1, 1960).

Describes a method of timing scintillation counter pulses by feeding the current pulse from a photomultiplier to a ringing circuit, the output of which is used to drive the vertical deflection plates of a c.r.o. with internal trigger. Standard light pulses are converted by a photomultiplier to standard current pulses, the time position being measured by a Moody discriminator. R.H.Thomas

621.374.32 : 539.1.07

7758 COINCIDENCE ARRANGEMENT WITH HIGH TIME RESOLUTION USED TOGETHER WITH A 100-CHANNEL PULSE-HEIGHT ANALYZER. B.Johansson.

Nuclear Instrum., Vol. 1, No. 5, 274-9 (Sept., 1957).

A time-correcting circuit is described which compensates for timespread due to different pulse heights. A resolving time of $2\tau_0 = 9$ mμs is obtained with NaI(Tl) crystals for gamma energies above 50 keV.

621.374.32 : 539.1.07

7759 MULTIPLE FAST COINCIDENCE UNIT. K.Skarsvåg.

Nuclear Instrum., Vol. 3, No. 6, 336-40 (Dec., 1958).

A fast diode coincidence unit which can be driven by photomultiplier pulses is described. The coincidence circuit can be changed from a double to a triple or quadruple by a switch. A resolving time, τ, of about 3 mμsec with 100% efficiency can be achieved. The dead times following non-coincident and coincident input pulses are about 16 and 70 mμ sec respectively.

621.374.3

7760 A 200 CHANNEL PULSE HEIGHT ANALYZER. C.Cottini and E.Gatti.

Nuclear Electronics Conference, Paris, 1958, Vol. 1. (see Abstr. 4975 of 1960) p. 281-6.

The analyser uses amplitude-to-time conversion and a transistorized magnetic core memory. The address circuits are decimal, and the channels may be arranged as 10×20 or 2×100.

W.G.Stripp

621.374.32 : 539.1.07

7761 A LOGARITHMIC, CONSTANT PERCENT ERROR, PULSE HEIGHT ANALYZER.

A.Alberigi-Quaranta, C.Bernardini, C.Infante and I.F.Quercia.

Nuclear Instrum. and Methods, Vol. 5, No. 2, 120-3 (Aug., 1959).

A single channel pulse-height analyser with a dead time of about

0.15 μsec is described. The channel width is determined by the passive characteristics of a delay line and is a constant percentage of the discriminator setting. An important feature of the device is a paralysis circuit. Circuit diagrams and calibration curves are given.

621.374.32 : 539.1.07

7762 CHARGE-STORAGE PULSE-HEIGHT ANALYZERS FOR USE WITH PULSED ACCELERATORS. L.Costrell and R.E.Brueckmann.
Nuclear Instrum., Vol. 3, No. 6, 350-8 (Dec., 1958).

Storage type pulse-height analysers for use with low duty cycle pulsed accelerators are discussed and an analyser described that accommodates up to nine pulses in a single burst with a resolution of two microseconds. The pulses to be analysed are temporarily stored as lines of charge on the face of a cathode-ray tube and are analysed by means of an electron beam that detects the charge discontinuity at the peak of the pulse. The pulse-height information is then permanently stored in a magnetic core memory.

621.374.32 : 539.1.07

7763 A TRANSISTORIZED RADIATION MONITOR. D.C.Brown and B.P.Faraday.
Nuclear Instrum., Vol. 1, No. 3, 133-7 (May, 1957).

Describes the investigation of a number of possible semiconductor devices which can be used for the detection of radioactive particles. The sensitivities of two types of transistor (a p-n-p alloy junction and an n-p-n grown junction) and a p-n alloy junction diode operated up to its "avalanche" condition were determined. The possible uses of such detectors are discussed and they are shown to be particularly suitable where high rates of counting, with good efficiency and small detecting area (or low geometry) are required. A completely transistorized radiation monitor has been developed using a p-n-p transistor as the detector head. This is a specifically designed for α-particle detection but the detector head with slight modification should be suitable for proton or neutron detection.

621.374.32 : 539.1.07

7764 A VERY FAST PULSE-HEIGHT ANALYSER WITH INDEPENDENT UPTAKE, SORTING AND STORAGE OF INFORMATION. R.V.Gàsström.
Nuclear Instrum, Vol. 1, No. 2, 75-9 (March, 1957).

A kicksorter is proposed with an uptake resolution of the order of 10^{-8} s and a mean counting rate without loss of 10^8 p.p.s. The principle is suited for both continuous as well as intermittent sorting and is based on a storage-tube display of the uptake which is scanned for sorting. The read-off information is temporarily stored per channel before it is injected into a large capacity accumulating memory.

621.374.32

7765 ACHIEVING DISCRIMINATOR LEVELS WITH A BIASED INPUT DIODE. F.S.Goulding and L.B.Robinson.
Electronics, Vol. 33, No. 21, 89-91 (May 20, 1960).

Describes the operation of a pulse-height discriminator successfully used in nuclear physics work. A forward-biased shunt diode is used in the input circuit; the signal reduces the standing current in the diode, increasing its impedance, and the loop gain of the trigger circuit. If this loop gain exceeds unity the discriminator triggers. Variations in the voltage drop across the diode have little effect on the discrimination level, thus considerably improving the stability compared with using the diode as a biased voltage discriminator. Circuit values are given, and the operation is described in detail. Its application as a voltage discriminator is outlined.
E.F.Hansford

621.374.32 : 539.1.07

7766 A FAST STORAGE SYSTEM FOR MULTICHANNEL PULSE HEIGHT ANALYSIS. G.F.Pieper.
Nuclear Electronics Conference, Paris, 1958. Vol. I (see Abstr. 4975 of 1960), p. 225-31.

The pulses to be analysed are written into a c.r.t. store as vertical deflections. The screen is then scanned by a television-type raster starting from the bottom, and pulse heights determined by the charge discontinuities at the peaks. W.G.Stripp

621.374.32 : 539.1.07

7767 TRANSISTORIZED COINCIDENCE CIRCUIT FOR π-e EXPERIMENT. R.H.Miller.
Rev. sci. Instrum., Vol. 31, No. 10, 1047-51 (Oct., 1960).

A special purpose coincidence circuit with millimicrosecond resolution time is described which illustrates the simplicity that can be achieved with transistorized circuits. The circuit performs all the logical operations of three simultaneous experiments to measure the branching ratio to the electronic mode of pion decay. Performance data under operating conditions on the cyclotron are given.

621.374.32 : 539.12

7768 A MULTI-CHANNEL GAMMA-RAY SPECTROMETER WITH AUTOMATIC COMPTON OR BACKGROUND SUBTRACTION. D.M.C.Thomas and W.J Callow.
Nuclear Electronics Conference, Paris, 1958. Vol. I. (see Abstr. 4975 of 1960), p. 117-26.

The spectrometer uses a NaI:Tl crystal, with Compton contribution compensation by subtraction of the spectrum of an anthracene crystal. A gated cathode-follower passes the photomultiplier outputs to a common amplifier and a modified Hutchinson Scarrott analogue-to-time converter, feeding an adder, storage and display system. 93 channels, each 0.4 V wide, with a capacity of 16 binary digits, are available. The add–subtract function may be reversed only during the time between a pulse being cleared from the converter and the arrival of the next pulse at the input. W.G.Stripp

621.374.32 : 539.12

7769 A GAMMA RAY SPECTROMETER FOR ENERGIES UP TO 1 GeV. M.Beneventano, U.Pellegrini, B.Rispoli, G.C.Sacerdoti, P.G.Sona and R.Toschi.
Nuclear Electronics Conference, Paris, 1958. Vol. I. (see Abstr. 4975 of 1960) 107-16.

A detailed description of the magnet and target design for the spectrometer, which was under construction. The pole pieces are trapezoidal, with widths of 1100 mm and 300 mm. Water-cooled copper coils with 120 turns and a maximum current of 2100A, stabilized to 0.1%, give a maximum flux density in the 100 mm gap of 2 Wb/m^2. In the upper pole, 36 holes are drilled to enable scintillation counters to be inserted. Electron pairs of equal energy are detected by two different three-fold coincidences, and by prompt and delayed coincidence circuits, which are also described.
W.G.Stripp

621.374.32

7770 PRINTED DIODE AND RESISTOR MATRICES. II. E.J.Schubert.
Electronic Industr., Vol. 19, No. 1, 88-91 (Jan., 1960).

For Pt I, see Abstr. 4993 of 1960. A general analysis of the operation of resistor matrices in the conversion of digital codes is used to illustrate the applicability of a printed form of manufacture, the techniques for which are briefly mentioned. G.H.Stearman

621.374.32 : 539.1.07

7771 FAST SCALING CIRCUITS. G.W.Hutchinson, W.H.Wells and D.H.White.
Nuclear Instrum. and Methods, Vol. 4, No. 4, 228-33 (May, 1959).

A scaler of 11 mμsec dead-time has been designed and built for use at the Birmingham proton synchrotron. This unit is described and the circuit elements that are used to define the dead time of scalers are discussed.

621.374.32 : 539.1.07

7772 HIGH SPEED TRANSISTORIZED SCALE-OF-TWO. E.Baldinger, P.Santschi and P.Wehrli.
Nuclear Instrum. and Methods, Vol. 4, No. 2, 117 (March, 1959).

621.374.32 : 539.1.07

7773 A FAST SCALING STAGE. F.A.Muller.
Nuclear Instrum and Methods, Vol. 4, No. 2, 115-16 (March, 1959).

A description is given of a new type of scaling stage. The tested circuit, with stray capacitances kept at a minimum, operated on incoming pulses up to 100 Mc/s.

621.374.32

7774 A FAST RING COUNTER AS AN ELECTRONIC SWITCH. W.Gruhle.
Nuclear Instrum., Vol. 3, No. 4, 204-6 (Oct., 1958). In German.

An improved ring counter is described which can be extended to any number of stages. The use of modern switching tubes allows counting rates up to 1 Mc/s, every stage giving separate output pulses without loading effect on the cycling process. For programme

switching application more than one state may simultaneously pass around the ring.

621.374.32

7775 MAGNETIC-MEMORY SCALING-SYSTEM WITH MAGNETIC COUNT INDICATION.
E.Franklin and J.B.James.
Nuclear Instrum., Vol. 2, No. 4, 345-60 (May, 1958).

Circuits are described which have many advantages over those at present being used in scaling equipment. Principally they make possible the design of scaling equipment which is small, light, cool running, of low power consumption, and very reliable.

621.374.32

7776 READ-OUT SYSTEM FOR THE HUTCHINSON-SCARROTT ANALYSER. J.Hansén.
Nuclear Instrum., Vol. 3, No. 5, 271-4 (Nov., 1958).

A read-out system is described which by a subtraction method gives recorded number of pulses in the different channels on a scaler. The arrangement is specially made for binary coded analysers.

621.374.32

7777 A CURRENT INTEGRATOR WITH DIGITAL OUTPUT. C.Daum.
Nuclear Instrum. and Methods, Vol. 5, No. 2, 75-7 (Aug., 1959).

This note contains a proposal to integrate currents larger than 1 μA by utilizing their magnetizing action. The proposed method eliminates the usual integrating capacitor with the associated leakage and soakage problems and gives the value of the collected charge in digital form.

621.374.32 : 621.318.57 : 621.383.2

7778 HIGH-SPEED LIGHT OUTPUT SIGNALS FROM ELECTROLUMINESCENT STORAGE SYSTEMS.
G.R.Hoffman, D.H.Smith and D.C.Jeffreys.
Proc. Instn Elect. Engrs, Paper 3217 M, publ. Feb., 1960 (Vol. 107 B, 599-605, 605-7).

Republication, with discussion, of the paper already abstracted as Abstr. 1571 of 1960.

621.374.32 : 621.318.13

7779 FERRITE-CORE MEMORY SYSTEMS WITH RAPID CYCLE TIMES.
D.B.G.Edwards, M.J.Lanigan and T.Kilburn.
Proc. Instn Elect. Engrs, Paper 3307 M, publ. Nov., 1960 (Vol. 107B, 585-98).

Improvements in storage systems using currently available square-loop ferrite cores are considered. These enable the normal cycle time of 6-10 microsec to be reduced to less than 2 microsec. Effort has been concentrated on the word-selected two-core-per-digit arrangement, and the most promising techniques are those which involve partial-flux switching. A system is developed suitable for a store of 1024 words of 52 digits with a cycle time of about 1.6 microsec. In a smaller store of, say, 100 words, a cycle time of approximately 0.6 microsec is feasible.

621.374.32

7780 THIN-FILM CRYOTRONS. I. PROPERTIES OF THIN SUPERCONDUCTING FILMS. C.R.Smallman.
Proc. Inst. Radio Engrs, Vol. 48, No. 9, 1562-8 (Sept., 1960).

This paper, consisting of three parts, describes the thin-film cryotron. This device, constructed by vacuum deposition of layers of lead, tin and silicon monoxide, is considerably smaller and faster than its wire-wound predecessor. Pt I describes the characteristics superconductive films as they apply to cryotrons. Their current-carrying capacity has been found to be proportional to width and proportional to thickness when the film is thinner than twice the penetration depth. Thermal effects caused by poor heat transfer to the bath distort the data, and the use of quartz substrates and low duty-cycle pulse measurements help to reduce this distortion. The function of a superconductive reflector or ground plane under a film is discussed. The current-carrying capacity of such a film is increased because of effective cancellation of the normal component of magnetic field.

621.374.32

7781 II. CRYOTRON CHARACTERISTICS AND CIRCUIT APPLICATIONS. A.E.Slade.
Proc. Inst. Radio Engrs, Vol. 48, No. 9, 1569-76 (Sept., 1960).

Pt II describes the characteristics of the thin-film cryotron. The superconducting to normal transition in a tin gate 0.125 in. wide and 3×10^{-6} cm thick is controlled by current in a single lead control, 0.0006 in. wide, which crosses the gate. Silicon monoxide is used for insulation. The switching time of a cryotron circuit is dependent upon the inductance and resistance of the circuit. Therefore, it is important to reduce the inductance by using a superconductive ground plane and by reducing the length of all interconnecting leads. Nonlocking flip-flops have been constructed, and a ring of five flip-flops have operated with a delay per stage of $\frac{1}{2}$ μsec.

621.374.32

7782 III. AN ANALYSIS OF CRYOTRON RING OSCILLATORS. M.L.Cohen.
Proc. Inst. Radio Engrs, Vol. 48, No. 9, 1576-82 (Sept., 1960).

Pt III is a circuit analysis of cryotron ring oscillators. Ring oscillators have been constructed so that the dynamic behaviour of film cryotrons in circuits could be studied. The analysis is concerned with the frequency-L/R time-constant and circuit resistance–gate resistance relationships so that the results of measurements on oscillators can be properly interpreted. Two analyses, based on different ideal characteristics, are made. The first treats each stage as a linear amplifier, and the second treats each stage as a switching circuit. Although the two analyses start with rather different assumed ideal characteristics, the results agree in many respects.

621.374.32 : 681.142

7783 USING FERRITE CORES TO RECOGNIZE WORDS. M.A.Merkel.
Electronics, Vol. 33, No. 39, 66-7 (Sept. 23, 1960).

A word spotter, consisting of twelve stages and able to recognize words containing a maximum of twelve letters at any speed up to 50 000 words a minute, is described. A block diagram of one stage is shown. The fixed memory, or vocabulary, uses manganese zinc ferrite cores. A detailed description of the complete sequence of operations, including the fixed and moving memories is included.
M.Goldberg

621.374.32 : 621.382 : 681.142

7784 A NEW SEMICONDUCTOR MEMORY ELEMENT WITH NON-DESTRUCTIVE READ-OUT AND ELECTRO-STATIC STORAGE. V.H.Grinich and D.Hilbiber.
I.R.E. WESCON Convention Record, Vol. 4, Pt 3, 34-41 (1960).

A method of information storage is described which utilizes the stored charge in the depletion layers of a p-n-p-n structure. Presence of a large space charge indicates a "zero", and a smaller charge a "one". In the determination of the existing state of the device, advantage is taken of the fact that the point at which breakdown occurs in a p-n-p-n device is a function of the rate of rise of the applied voltage, dV/dT. If one assumes a device with all junctions initially discharged, a voltage pulse having an amplitude less than V_S, the switching voltage, and a sufficiently short rise time will cause the device to switch. If, however, the middle junctions were previously charged to some level less than V_S at a sufficiently slow rate, the application of the first pulse would not result in a breakdown. Therefore, by selection of a proper "interrogation" pulse, and monitoring the current through the device, one may readily determine the storage state. Since this method is electrostatic, the only input power to the device is that which supplies the charge lost due to stray leakages. A non-destructive read-out is obtained since "interrogation" does not alter the existing state. Instead, it acts to regenerate the state that already exists. Other advantages include a high signal-to-noise ratio and the feasibility of constructing micro-memory systems. Experimental results are discussed.

621.374.32

7785 ELIMINATING DIODE REDUNDANCY IN ENCODING AND DECODING MATRICES. A.Freilich.
Control Engng, Vol. 7, No. 6, 110-14 (June, 1960).

A set of three rules is given which, by repeated application, allow the elimination of the maximum number of diodes from encoding and decoding matrices. Generally the method consists in detecting input functions which occur wholly or partly in exclusive combinations with each other. For two input functions, 0, 1 or 2 blocking diodes may be necessary, which reduces the saving. The method is applied to the optimizing of a matrix with 10 inputs and 7 outputs, resulting in a reduction of diode requirements from 47 to 31. Decoding matrices, in which combinations of inputs must specify a single

output, are treated as encoders by considering them in reverse. A binary to decimal encoder so designed uses 32 diodes instead of 40 for a straightforward arrangement. G.H.Stearman

621.374.32

7786 CYCLES IN LOGICAL NETS. J.H.Holland.

J. Franklin Inst., Vol. 270, No. 3, 202-26 (Sept., 1960).

Investigates the influence of cycles in a logical net upon the complexity of its behaviour. The investigation is mainly concerned with two questions: (1) a logical net with a periodic input sequence produces a periodic output sequence; how is the spectrum of periodic outputs related to the level of cycle complexity?; (2) is there a level of complexity c (suitably defined) such that any behaviour possible for a fixed logical net can be realized by a logical net constructed only of cycles of complexity $c' \leq c$? The first and more difficult question is fully answered only in the case of nets constructed of cycles having a feedback coefficient $r = 1$ (suitably defined). The second question is answered in the negative for individual cycles and it is conjectured that a similar answer holds for nets in general.

621.374.32 : 681.142

7787 A PARALLEL ARITHMETIC UNIT USING A SATURATED-TRANSISTOR FAST-CARRY CIRCUIT. T.Kilburn, D.B.G.Edwards and D.Aspinall.

Proc. Instn Elect. Engrs, Paper 3302 M, publ. Nov., 1960 (Vol. 107B, 573-84).

Describes a transistor switch technique which is of particular importance in applications where a large number of switches have to be connected in series and where the propagation time of information through these switches has to be a minimum. It is thus of importance in parallel addition, and its use in this connection has been successfully demonstrated, yielding an addition time over 24 digits of 300 millimicrosec. The technique is reasonably economical, and it is shown how it can be used in conjunction with more conventional logical circuits to provide a simple arithmetic unit.

621.374.32

7788 ANALYSIS AND DESIGN OF THE TWIN-TUNNEL-DIODE LOGIC CIRCUIT. C.H.Alford, Jr.

I.R.E. WESCON Convention Record, Vol. 4, Pt 2, 94-101 (1960).

A simple configuration of two tunnel diodes in series exhibits bistable operation. The mode of operation is explained and the problem of triggering investigated. It is shown that a balanced three-phase supply allows interconnections of numbers of circuits without ambiguity of signal flow, by arranging that between each "transmit" phase and "receive" phase there occurs a P "passive" phase in which the circuit is inoperative. The effect of load current is investigated leading to the development of a design procedure to allow for diode characteristic tolerances. By means of this procedure the limits on the supply voltage and interconnecting resistors are determined. The elements perform a majority logic function. G.H.Stearman

621.374.32

7789 NOVEL ADDER–SUBTRACTER CIRCUIT UTILIZING TUNNEL DIODES. R.A.Kaenel.

I.R.E. WESCON Convention Record, Vol. 4, Pt 3, 53-64 (1960).

Two binary counter configurations were devised which fully exploit the properties of a modified tunnel diode flip-flop. A bipolar regenerative gate and a conventional flip-flop utilizing tunnel diodes are described and partially analysed. Experimental results are given which demonstrate the feasibility and reliability of the circuit. The counter stages described combine memory, gate, and amplifier without impairing reliability. The economy inherent in this arrangement gives the designer latitude in adding regenerative amplifiers to improve reliability.

621.374.32

7790 DIODELESS CORE LOGIC CIRCUITS. S.B.Yochelson.

I.R.E. WESCON Convention Record, Vol. 4, Pt 4, 82-95 (1960).

A logic mechanization system, suitable for digital computers and data processors, has been developed. This system is based on the use of conventional square-loop ferrite magnetic cores for all operations. It differs from common core–diode or core–transistor logic systems in that no semiconductors or other active coupling elements are needed and differs from other diodeless core logic systems in that there are no inherent limits on speed, logic capabilities, or branching (fan-out) capabilities other than the characteristics of the cores themselves. The system uses the threshold characteristics of the magnetic cores as the nonlinearity needed to achieve directivity of information flow. In addition to the cores needed as information storage elements, added cores are used in place of the diodes or similar nonlinear devices found in conventional core logic systems. Control of directivity is achieved by biasing certain cores up to their thresholds, resulting in the inhibiting of of some cores from switching and the aiding of the switching of others. Arrangements are made so that the voltage induced into each coupling loop by a switching core are always opposed by another switching core. Hence, there is no need to reset some cores slowly.

621.374.32

7791 TUNNEL DIODE LOGIC CIRCUITS. W.F.Chow.

Electronics, Vol. 33, No. 26, 103-7 (June 24, 1960).

The basic characteristic of a tunnel diode is described and it is shown that the existence of a negative resistance region permits both monostable and bistable operation. Two principal forms of logic are available; the first is analogue-threshold in which the diode generates an output when the sum of the currents from a number of inputs is just great enough to trigger it. The second is majority decision logic, generating a positive or negative output according as the majority of an odd number of inputs are positive or negative respectively. The main difficulty in using such circuits is their bilateral behaviour and special means must be employed to ensure a flow of information in a predetermined direction. In this respect tunnel diode logic resembles parametron logic and similar solutions to the problem may be invoked. Equations are presented leading to sets of curves which relate the component and diode tolerances to the number of inputs and outputs allowable. A typical result requires 3% diode and 2% component tolerances for 3 inputs and 3 outputs. G.H.Stearman

621.374.32

7792 GENERATING HIGH QUALITY CHARACTERS AND SYMBOLS. J.K.Moore and M.Kronenberg.

Electronics, Vol. 33, No. 24, 55-9 (June 10, 1960).

Describes the application of digital techniques to a solid-state character generator which will display 20 000 characters per second on an oscillograph screen. Much higher speeds are possible with lower symbol quality. The unit is basically a function generator giving a character formed from a line raster. A multi-plane read-only magnetic-core matrix memory, where the core selection lines have the configuration of the stored symbols, generates the parallel bits for each raster line in turn. By logical circuitry this is converted to serial form and the video signal obtained. A brief description of the complete display system is given. D.J.Truslove

621.374.32 : 681.142

7793 ELECTRICAL READOUT. S.Feinstein and H.J.Weber.

Electronics, Vol. 33, No. 31, 100-2 (July 29, 1960).

A method of reading out information contained in a thin ferromagnetic film is described. A region of the film is magnetized by a current flowing through a drive wire perpendicular to the easy axis of magnetization. The film is interrogated by passing a current pulse through the drive wire, a signal being induced in an astatically coupled pick-up loop should the pulse cause a reversal of magnetic polarity. In the test arrangement described, pulse generators are used to magnetize the thin film with alternating polarity whilst the output from the pick-up loop is amplified and displayed on an oscilloscope. Outputs of 0.5 mV were obtained from a single magnetic domain 0.1×0.002 in. in size, the pulse width of the interrogating current being approximately 70 nanosec. A.S.Hay

621.374.32

7794 A HIGH SPEED ANALOGUE TO DIGITAL CONVERTER. Y.Hazoni.

C.R. Acad. Sci. (Paris), Vol. 251, No. 3, 343-5 (July 18, 1960). In French.

The first section of the analogue to digital converter transforms the input signal into a rectangular pulse the duration of which is proportional to the input amplitude. The second section is an oscillator which is normally cut off but oscillates for the duration of the rectangular signal received from the first section. The circuit used should enable the dead time to be reduced to a tenth of that obtained

with present systems. The first section is completely transistorised. The oscillator consists of a tunnel diode connected in the emitter circuit of an OC 170 transistor. The self capacitance and inductance of the diode and its connections give an oscillation frequency of 10 Mc/s. If a small inductance is connected across the diode, the frequency may be increased to 40 Mc/s. A.S.Hay

621.374.32

7795 STATIC SWITCHING. G.T.Ohlsen.

Electronic Engng, Vol. 32, 609-13 (Oct., 1960).

The purposes and advantages of static switching and its derivation from digital computer techniques are outlined. A comparison of existing techniques is made and a complete system employing "Nor" units as the logic element is described, together with the treatment and solution of a simple problem.

621.374.32

7796 "ISABEL" (ISO STATUS ACCUMULATING BINARIES USING EXTRAORDINARY LOGIC). J.A.Goss.

Electronic Engng, Vol. 32, 630-4 (Oct., 1960).

An improved logical arrangement of a decimal counter based on bistable elements is described. The advantages over usual methods are described, and the performance of various circuits using this method is given.

621.374.32 : 621.318.5

7797 MINIMIZATION OF THE BOOLEAN FUNCTIONS CHARACTERIZING SWITCHING CIRCUITS. M.A.Gavrilov.

Avtomat. i Telemekh., Vol. 20, No. 9, 1217-38 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 9, 1188-1207 (Sept. 1959; publ. May, 1960).

Considers a method for minimizing Boolean functions which characterize switching circuits, the method being based on an analysis of the conditions to be realized by the operation of the switching circuits.

621.374.32

7798 BOOLEAN FUNCTIONS REALIZABLE WITH SINGLE THRESHOLD DEVICES. M.C.Paull and E.J.McCluskey, Jr.

Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1335-7 (July, 1960).

Reviews the basic threshold property of square loop cores. Discusses setting functions for a single core and proposes two setting function theorems which define the unateness property and another special property which leads to certain constraints on core windings. Finally, the results of the first two theorems are generalized. D.J.Truslove

621.374.32 : 621.318.5

7799 ON ONE METHOD OF ANALYZING COMPLEX SWITCHING CIRCUITS. V.F.D'yachenko.

Avtomat. i Telemekh., Vol. 20, No. 10, 1417-25 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 10, 1382-90 (Oct., 1959: publ. June, 1960).

A method is presented for the analysis of switching circuits which is based on the finding of the intermediate relay windings and executive elements carrying current, and their interconnections, for each state of the circuit's contacts. Two-terminal class P and N switching circuits with multiwinding relays and parametric dependencies are considered.

621.374.32 : 621.318.5

7800 SWITCHING CIRCUIT OPERATION DURING TRANSITION PERIODS. V.N.Roginskii.

Avtomat. i Telemekh., Vol. 20, No. 10, 1409-16 (1959). In Russian English translation in: Automat. Remote Control, Vol. 20, No. 10, 1374-81 (Oct., 1959: publ. June, 1960).

A method is given for disclosing the possible disruptions in switching circuit operation during the periods of operation or release of the individual relays in the circuit, and recommendations are made for avoiding these disruptions.

621.374.32 : 621.318.5

7801 ON THE REALIZABILITY OF A SINGLE CONTACT SWITCHING FUNCTION. O.Wing.

Proc. Nat. Electronics Conf., Vol. 15, 481-6 (1959).

Four necessary but not sufficient conditions are presented which a switching function of n variables must satisfy in order to be realizable by a graph of n contacts without sneak paths. The path matrix of a two-terminal graph is defined and its one-to-one correspondence with a switching function is noted. The necessary conditions are given in terms of the properties that a matrix must have to be realized as the path matrix of a graph. One condition is that the set of columns of the matrix must contain at least two subsets such that the modulo 2 sum of the columns in each subset is a column of ones and such that no proper subset of the subset has this property. Another condition is that be deleting certain columns from the matrix, the remaining matrix again must satisfy the first condition. Thirdly, the set of columns must contain at least $v - 1$ subsets such that the submatrices formed by the subsets have the property that every row contains exactly two or none at all non-zero elements (v = the number of vertices in the graph). Finally, to avoid sneak paths, the given matrix must contain all paths (rows) generated by the modulo 2 sum of r linearly independent rows of the matrix, where r is the rank.

621.374.32 : 621.318.5

7802 MULTIVALUED SWITCHING ALGEBRAS AND THEIR APPLICATION IN DIGITAL SYSTEMS. E.I.Muehldorf.

Proc. Nat. Electronics Conf., Vol. 15, 467-80 (1959).

Binary switching algebra is widely used in the analysis and synthesis of switching circuitry. For some applications, however, there is a need for a nonbinary switching algebra. The natural step from two to three leads from a binary switching algebra to a ternary switching algebra. Sometimes an even higher valued algebra is necessary. A brief survey of ternary switching algebras is given. These algebras can be based on Post's modular algebra. For practical reasons it is, however, useful to change the concept and base the algebra on the so-called $j_k(x)$ functions as defined by Rosser and Turquette [Many Valued Logics, Amsterdam; North Holland Publishing Co. (1952)]. The extension of a practical ternary switching algebra to M values is given. In applying a nonbinary switching algebra to switching circuitry one can realize two cases. The one is to apply it to binary devices, the other is to apply it to multivalued devices. Possible applications are given with emphasis placed on multivalued devices. A set of logic circuits is given which is capable of performing nonbinary logical operations. Application of nonbinary switching circuitry to digital systems such as computers and communication systems is shown. A brief outline of the basic difference of the application in computers and communication systems is given.

621.374.32

7803 ADAPTIVE SWITCHING CIRCUITS. B.Widrow and M.E.Hoff.

I.R.E. WESCON Convention Record, Vol. 4, Pt 4, 96-104 (1960).

Experiments are described in which an adaptive neuron element is used in a simple model to recognize patterns initially presented to it in a training process. The neuron element consists of a threshold element activated by the algebraic sum of a number of weighted inputs. The weights are altered according to the result of a comparison between the element output and a term expressing the desired response. The results are stated of some theoretical investigations into the adaptive process and the predicted rate of adaptation shown to compare favourably with the measured rate in certain cases. Possible uses of more complex systems are suggested and include the realisation of proposals for higher reliability of computers by a "majority vote" principle, problem-solving and theorem-proving machines. The machine described is manual in operation but an automatic neuron element is stated to be in development. G.H.Stearman

621.374.32 : 621.382.3

7804 HIGH-CURRENT SOLID-STATE SWITCHES. C.H.Price, Jr.

Electronics, Vol. 33, No. 38, 72-3 (Sept. 1, 1960).

Describes a circuit used to provide current pulses of 34A, lasting 0.25 sec, at a p.r.f. of 1 c/s, into an inductive load for use with a falling sphere accelerometer. A unijunction transistor fires a conventional bistable multivibrator, which automatically selects the charging time constant for the next pulse from the unijunction transistor; thus any duty ratio and p.r.f. may be set. The output from the multivibrator is also amplified in a three-stage common-collector amplifier to provide a base drive to the common-emitter output stage, which has reverse bias during the off period to prevent thermal run-away. W.D.Gilmour

621.374.32 : 621.382.233

GERMANIUM p-n-p-n SWITCHES. See Abstr. 6823

621.374.33 : 631.318.572

7805 A FOUR-CHANNEL ELECTRONIC SWITCH FOR AN OSCILLOGRAPH. A.C.Breu and M.A.Page.
Rev. Cienc. apl., Vol. 14, No. 2, 137-40 (March-April, 1960). In Spanish.

The switch is designed for displaying the four signals representing a number in a digital accumulator. It uses a ring counter, triggered by timing pulses, which adds a rectangular waveform to the signal in each channel. The counter comprises four pentodes, with d.c. coupling between all anodes and grids. The correct sequence is assured by capacitors shunted across the appropriate coupling resistor. W.G.Stripp

621.374.4 : 539.1.07

7806 TWO PULSE FREQUENCY DIVIDERS WITH HIGH RESOLVING POWER. U.Pellegrini and B.Rispoli.
Nuclear Electronics Conference, Paris, 1958. Vol. I (see Abstr. 4975 of 1960), p. 217-24. In French.

The first circuit divides by 16 and uses four binary counters. These have cathode-follower cross-couplings to give fast rise times, and the divider has a resolution of 34×10^{-9} sec. It will divide from sinusoidal signals up to 30 Mc/s. The other circuit divides by 10, using a ring counter of EFP 60 secondary emission valves to divide by 5 and a normal binary stage. The resolution is similar to that of the first circuit. W.G.Stripp

621.374.4

7807 FREQUENCY MULTIPLIERS FOR FEEDING ELECTROLUMINESCENT CELLS. G.Batailler.
Bull. Soc. Franc. Elect., (Ser. 8), Vol. 1, 497-506 (July, 1960). In French.

Describes the limitations of the conventional doubler circuit when used to produce the frequency of several hundred cycles required by the cells. To eliminate the d.c. component, and the stray capacitance of the cells, a new circuit was developed, using two single-phase supplies in quadrature, each feeding a rectifier bridge, producing a 200 c/s output from a 50 c/s supply. The principle was extended to a circuit using four thyratrons to quadruple the frequency. E.F.Hansford

621.374.4

7808 HALL-EFFECT MULTIPLIERS. W.A.Scanga, A.R.Hilbinger and C.M.Barrack.
Electronics, Vol.33, No. 29, 64-7 (July 15, 1960).

The general principles of Hall multipliers are discussed and the relative advantages of Si, Ge, InAs, and InSb are compared. An experimental Hall multiplier with an accuracy of 0.1-1% with a bandwidth of several kc/s using InAs is described. With an input current of 300 mA into an impedance of 1.5 ohms and a field current of 100 mA the Hall output voltage is 70 mV, such levels indicate that transistor input and output circuits are best suited for this application. The design of a complete transistor multiplier circuit is given together with a discussion of its performance. A.P.C.Thiele

621.374.4 : 539.1.07

7809 ELECTRONIC PULSE SCALERS. I. RATIONALIZATION OF COUNTING CIRCUITS. R.L.Favre.
Nuclear Instrum., Vol. 1, No. 3, 113-22 (May, 1957). In French.

Deals with new electronic circuits for pulse counting. These circuits, more practical than the binary decades, allow superior performances to be obtained. A new device helps to reduce the decade resolution time for randomly distributed pulses to that of a wave-form shaping circuit. Thus the statistical loss in counting is almost eliminated.

621.374.4 : 539.1.07

7810 ELECTRONIC PULSE SCALERS. II. HIGH FREQUENCY SCALERS. R.L.Favre.
Nuclear Instrum., Vol. 1, No. 4, 201-12 (July, 1957).

Deals with high frequency scaling, in which the secondary-emission tube plays an important part. Aperiodic pulse generators, frequency dividers, pulse counters and electronic chronographs benefit from the proposed basic circuit. The frequency limit for these various applications reaches 30 Mc/s, while the electronic chronograph recurrence time can be lowered to 0.01 μs.

621.374.42

7811 HIGH POWER AT 1000 Mc/s USING SEMICONDUCTOR DEVICES. G.Leuttgenau, M.V.Duffin and P.H.Dirnbach.
I.R.E. WESCON Convention Record, Vol. 4, Pt 3, 13-26 (1960).

Describes devices and procedures used to develop an oscillator delivering 1 W at 1 Gc/s. Theoretical analyses and practical considerations with regard to the design of frequency multipliers are presented. A specific circuit fulfilling the above requirements is discussed, and block and circuit diagrams are included.

621.374.4

7812 AN ANALYSIS OF HARMONIC FREQUENCY-DIVIDERS. I.Kh. Rizkin.
Radiotekhnika, Vol. 15, No. 8, 33-41 (Aug., 1960). In Russian.

It is shown that the analysis of harmonic frequency dividers which are described by differential equations of an order higher than the second can, in a number of cases, be reduced to the analysis of an equivalent divider whose equation is always only of the second order. Examples are given of the working out of second-order equivalent circuits for two cases in general form. S.C.Dunn

621.374.4

7813 APERIODIC FREQUENCY DIVIDER WITH VARIABLE DIVISION RATIOS. K.H.v.Klitzing and J.Nitschke.
Z. InstrumKde, Vol. 68, No. 2, 39-42 (Feb., 1960). In German.

A report on frequency-divider equipments allowing division of frequencies in a large range of variable proportions. Small decade cold-cathode counter tubes are used.

621.374.4 : 621.317.35

SOME MEASUREMENTS OF INTERMODULATION AND HARMONIC DISTORTION IN HALL EFFECT MULTIPLIERS BY MEANS OF A MUIRHEAD-PAMETRADA WAVE ANALYSER. See Abstr. 7432

621.374.42

7814 ELECTRONIC TIMING SET (TIME ENCODER). J.Brazda.
Proc. Nat. Electronics Conf., Vol. 15, 860-73 (1959).

The Time Encoder is a self-contained electronic time piece designed for those systems requiring real time information. The accuracy of within ± 1 sec per day is achieved with a crystal controlled oscillator. Continuous output signals suitable for audio or graphical recording are provided with timing marker pulse frequencies of 6000 c/s, 60 c/s, and 1 c/s. The real time of day as a digitized pulse output in serial binary coded decimal form is available during each second interval of a 24 hr period. A six-digit numerical time display is driven from a common source to insure identical time readings at up to 10 remote positions with a resolution of 1 sec. Synchronous clock operation from a 110 V source with similar resolution capabilities is available. Associated equipment synchronization is possible with use of 6 kc/s, 120 c/s, or 1 c/s outputs. Circuit features are binary chains as frequency-dividers, diode programme-logic, and flip-flops as storage devices. Operation can be manual with stop clock features or can be automatically synchronized with WWV time standard broadcasts.

621.374.5

7815 COMMENTS AND EXTENSIONS TO THE KÜPFMÜLLER TRANSIENT FORMULA. G.Wunsch.
Hochfrequenztech. u. ElektAkust., Vol. 69, No. 1, 35-9 (Feb., 1960). In German.

The author has already generalized (Abstr. 1418 of 1956; and 1495 of 1960) the Küpfmüller theory so as to take into account the otherwise separate approaches via the Hilbert transformation and the Wiener–Paley criterion. The present note applies this work to a low-pass filter. Finally it is shown that the formula may be also extended to an all-pass delay circuit with an optimally equalized delay time. S.C.Dunn

621.374.5

7816 SERVO-CONTROLLED MAGNETIC-TAPE DELAY LINE. L.J.Kamm.
Instrum. Control. Syst., Vol. 33, No. 3, 438-9 (March, 1960).

Describes in general terms the servo drive and mechanical arrangements. Synchronization of the a.c. servomotors is by a clock channel on the tape. Ten analogue signal channels are available. Delay time ranges from 6 ms to 10 s. Photograph, diagram, and specification are given. K.C.Garner

621.374.5

7817 PULSED R.F. STORAGE IN LONG DELAY, BROADBAND CLOSED LOOP SYSTEMS. O.A.Huettner.
I.R.E. WESCON Convention Record, Vol. 4, Pt 2, 13-23 (1960).

Deals with the design and adjustment of broadband, closed loop, pulsed r.f. storage systems employing fused-silica delay lines. The operating bandwidth of this storage device is in the order of 40 Mc/s the storage time is in the order of several milliseconds. A quantitative analysis of the storage time, in terms of delay attenuation, media delay, regeneration-enhanced loop noise, and broadband amplifier noise figure and saturation characteristics is developed. Specific design requirements of the broadband amplifiers, equalization networks and automatic gain control circuitry are also discussed. Some peculiarities associated with operation of broadband fused-silica delay lines in this application are detailed, and practical design solutions to these peculiarities are indicated.

621.374.5 : 681.142 : 539.1.07

7818 PROPOSAL FOR AN ANALOG-TO-DIGITAL ELECTRONIC CONVERTER SUITED FOR NUCLEAR PULSE HEIGHT ANALYSIS. A.Alberigi, C.Bernardini and I.F.Quercia.
Nuclear Instrum., Vol. 3, No. 4, 201-3 (Oct., 1958).

An analogue-to-digital convertor is proposed based on the use of delay lines as codifying elements. Application of the convertor to pulse height analysers, with one or more channels, is discussed. Preliminary experimental work is briefly reported.

621.374.5 : 539.1.07

7819 MULTIRANGE DELAY LINE FOR APPLICATION IN BETA-GAMMA COINCIDENCE STUDIES.
I.D.Du Plessis, P.W. De Lange and W.Weidemann.
Nuclear Instrum. and Methods, Vol. 5, No. 2, 127-8 (Aug., 1959).

The circuit of a counting delay unit with a range of 0 to 11.4 μsec in steps of 0.1 μsec is described. A continuous adjustable delay line (0.05 μsec per cm) covers a range of 1.5 μsec. The construction and design formulae of the latter delay line is given.

621.374.5

7820 A NON-RETURN TO ZERO (NRZ) MODE OF OPERATION FOR A MAGNETOSTRICTIVE DELAY LINE. A.Rothbart.
Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1486-7 (Aug., 1960).

The non-return-to-zero model is defined as one where a digital "one" is generated by a change in current in the transmitter from zero to one or vice versa. Using this mode, a delay line when used as a store can operate at twice the clock rate of conventional stores. A block diagram of the receiver circuitry is given and its operation is described. A.P.C.Thiele

621.318.57 : 538.1

7821 ON OPTIMUM FIELD HOMOGENEITY OF HIGH ENERGY COIL MAGNETS.
R.S.Ingarden and J.Michalczyk.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 8, No. 4, 319-24 (1960).

The problems of designing high energy magnet coils of optimum dimensions to satisfy these three criteria: (1) largest possible field, (2) optimum homogeneity, (3) smallest coil size and weight, are discussed in general. The particular case of a split solenoid is considered, and optimum dimensionless parameters derived.
S.A.Ahern

621.318.57

7822 THE TRANSISTOR GUARD. . . .A SOLID STATE CIRCUIT BREAKER. J.V.Hanson.
Electronic Industr., Vol. 19, No. 7, 78-80 (July, 1960).

The breaker protects circuits carrying currents in the milliampere range. It comprises a power transistor and a low-power high-voltage switching transistor connected in a bistable flip-flop circuit. The operation of the transistor as a switch is described, and the method of operation of the breaker circuitry. The breaker is triggered when excessive current passes through a variable resistance in series with the emitter of the power transistor, this resistance and the emitter being shunted by a diode. The factors determining the turn-off time are outlined and typical values are given as 200-400 μs. E.F.Hansford

621.318.57

7823 DESIGNING SOLID-STATE STATIC POWER RELAYS. R.F.Blake.
Electronics, Vol. 33, No. 22, 114-17 (May 27, 1960).

Describes the superior performance and reliability, compared with mechanical types, of relays using silicon controlled rectifiers. The design requirements for the control circuit and for correct gating are explained with reference to an a.c. contactor circuit. The design is outlined for a static a.c. power relay, a latching d.c. contactor and a circuit-breaker. E.F.Hansford

AMPLIFIERS

(Abstracts on magnetic amplifiers appear also under Inductors . Reactors)

621.375.1

7824 OPERATION OF A RESONATOR-TYPE CLASS C AMPLIFIER WITH A DETUNED ANODE CIRCUIT. J.Osiowski.
Arch. elektrotech. (Warsaw), Vol. 7, No. 4, 693-722 (1958). In Polish, with summary (2 pp.) in English.

With reference to previous papers by the author (Abstr. 3725 of 1954; 4202 of 1957) the behaviour of a detuned amplifier for transient and continuous events is mathematically treated in terms of amplitude (modulus) and phase relationships. Anode voltage curves are shown for detuning frequency ratios: 0.5, 0.8, 1.1, 1.4
A.Sczaniecki

621.375.1

7825 TYPICAL THREE-TERMINAL BRIDGE-TYPE DIRECT-CURRENT AMPLIFYING STAGES. A.A.Sokolov.
Elektrotech. Obzor, Vol. 49, No. 6, 282-5 (1960). In Czech.

Presents and analyses the performance of three types of amplifying stages, derives equivalent-circuit diagrams and relations for the calculation of basic parameters. N.Klein

621.375.1

7826 INVESTIGATION OF TRANSIENT PROCESSES IN CLASS B AMPLIFIERS, CAUSED BY THE REACTIVE CHARACTER OF IMPEDANCES OF SUPPLIES. A.T.Balanov.
Radiotekhnika, Vol. 15, No. 7, 67-74 (June, 1960). In Russian.

When high-power class B push-pull amplifiers are fed from a.c. rectifiers, the smoothing filters represent reactive impedances due to the finite value of capacitors and chokes. Such a reactive impedance causes distortion of the amplified signal. An analysis of distortion is given with the aim of evaluation for practical applications. The case of an amplifier with negative feedback is also considered. Experimental results are compared with the analysis. A.Woroncow

621.375.121.2

7827 A PRINTED DISTRIBUTED AMPLIFIER. P.R.Orman.
Nuclear Instrum., Vol. 1, No. 6, 354-8 (Dec., 1957).

A distributed amplifier is described which has been designed for applications in the field of nuclear physics research. The gain of the amplifier is 20 dB and its rise-time less than 2.5 mμs. Printed wiring techniques have been applied and the theoretical and practical advantages of this method of construction are considered.

621.375.13

7828 MULTILOOP FEEDBACK AMPLIFIERS ANALYSIS. L.M.Vallese.
Proc. Nat. Electronics Conf., Vol. 15, 718-26 (1959).

By application of forward equivalent network transformations, the analysis of multiloop feedback amplifiers is reduced to that of a cascade combination of unilateral amplifiers. This provides a different approach to the investigation of stability and compensation problems, replacing the consideration of the return difference with that of a driving point immittance function. The corresponding modifications in the application of Nyquist and Bode criteria are discussed with reference to single and multiloop systems. For the latter case the approach results in simpler and more physically significant procedures of analysis.

621.375.13

7829 TRANSIENT RESPONSE AS A DESIGN CRITERION FOR STABILIZATION OF FEEDBACK AMPLIFIERS. J.H.Mulligan, Jr.

Proc. Nat. Electronics Conf., Vol. 15, 747-60 (1959).

A design criterion for use in the stabilization of feedback amplifiers is discussed which is concerned directly with pole locations and with a feature of the transient response. The criterion is the relative damping of the amplifier step-function response, i.e., the ratio of the deviations from unity in the normalized time response at two successive extreme values. Use of the proposed criterion in conjunction with a dominant term approximation to the transient response to formulate design equations for representative transistor and vacuum-tube amplifier stages is demonstrated. Transient response curves for a particular design, using various values of mid-band loop gain, illustrate the effect of parameter changes on the stabilization design parameter.

621.375.2

7830 REMOTE PREAMPLIFIERS FOR UNDER OCEAN WORK. J.V.Shaefer.

Electronics, Vol. 33, No. 28, 60-2 (July 8, 1960).

Hydrophones for measuring ambient sea noise are mounted with preamplifiers in water-tight housings which can be lowered on cables several miles long. A single pair cable is used for both power supply and signal transmission. V.G.Welsby

621.375.2 : 621.374.5

7831 DELAY-LINE CONTROLS TUNED AMPLIFIER. I.F.Barditch.

Electronics, Vol. 33, No. 31, 108 (July 29, 1960).

Two essentially similar amplifying stages having feedback loops with slightly greater than unity gain are connected to the input and output of an electromagnetic delay line. The delay line may be either fixed or variable. The output is fed both to an external load and the input of the first amplifier when summation will occur for frequencies appearing in proper phase at the input summing resistor. The Q can be controlled by this feedback and the centre frequency by the length of the delay line. With such a circuit a Q of 285 at centre frequency 500 kc/s was achieved. Several stages can be cascaded to form a high gain i.f. amplifier of controllable gain and bandwidth, each adjustment being orthogonal to the other. A.P.C.Thiele

621.375.2

7832 WIDE-RANGE MULTIPLE-PULSE AMPLIFIER. R.E.Koncen.

Electronics, Vol. 33, No. 38, 78-91 (Sept. 16, 1960).

Various possible designs for an amplifier, whose minimum performance requirements are a voltage gain of 80 dB, dynamic range of 60 dB, bandwidth of 1 Mc/s, output signal of 10 V peak into a load of 5000 ohms, and negligible recovery time and pulse stretching compared to that due to the crystal detector, are described. The final design uses four inverse-feedback pairs including instantaneous automatic gain control. The final amplifier meets the above specification, apart from some pulse stretching, and a complete circuit diagram is given. A description of the techniques used to measure amplifier performance and six useful references are also included. M.Goldberg

621.375.2 : 537.54

7833 THE 2.5 MW H.F. AMPLIFIER OF THE CERN LINEAR ACCELERATOR. E.Zaccheroni.

Nuclear Instrum. and Methods, Vol. 5, No. 2, 78-89 (Aug., 1959).

Contains a description of the grounded-grid amplifier using tuned coaxial lines designed for meeting h.f. power requirements of the Cern linear accelerator. Performance curves are given for this amplifier terminated in a matched load or short circuited. Guidance is given in choosing a suitable working point to prevent damage in the cavity and in the cables due to an external mismatch.

621.375.2

7834 CHART FOR A LINEAR AMPLIFIER WITH A COMPLEX LOAD. J.Forejt.

Slaboproudy Obzor, Vol. 21, No. 9, 521-6 (1960). In Czech.

The formula for the gain of a single-stage amplifier with complex load is analysed. It is shown that in rectangular coordinates x and r (where x denotes the normalized reactive component of the load and r is the resistive component), the formula can be represented graphically by a set of constant-gain (amplitude) circles and a family of constant-phase circles. By inversion the constant-gain circles can be transformed into a different set of circles and the phase circles become straight lines. In this manner a chart similar to that of Smith is obtained. The loci of constant-power gain, maximum power gain and minimum voltage gain are also determined and these are plotted in the chart. R.S.Sidorowicz

621.375.232.3

7835 AN ELECTROMETER TUBE STAGE FOR LARGE INPUT VOLTAGES. E.Gass.

Elektronik, Vol. 9, No. 5, 142 (May, 1960). In German.

An E80F pentode has a triode as cathode load. The E80F is operated at reduced heater-voltage and its screen voltage is stabilized by Zener diodes. The output is taken through a conventional cathode-follower. The zero drift, for 10% mains voltage variations, is about 15 mV. W.G.Stripp

621.375.3

7836 CALCULATION OF A.C. MAGNETIC REACTOR AMPLIFIERS WITH INTERNAL FEEDBACK. N.A.Kaluzhnikov.

Avtomat. i Telemekh., Vol. 20, No. 5, 606-21 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 5, 582-96 (May, 1959: publ. Feb., 1960).

Typical circuits of magnetic amplifiers with internal feedback are considered. The circuits are analysed in two cases which are extreme from the point of view of nonsinusoidal distortion. Possible calculation errors are estimated. The results of the analysis are given in the form of design curves.

621.375.3

7837 CONTROL CHARACTERISTICS OF THREE-PHASE MAGNETIC AMPLIFIERS. A.L.Pisarev.

Avtomat. i Telemekh., Vol. 20, No. 5, 622-36 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 5, 597-609 (May, 1959: publ. Feb., 1960).

Deals with two three-phase magnetic amplifier circuits, which differ in the method of connecting the phase control windings. Static operation of the circuits is described. Analytical expressions for the control characteristic of amplifiers of both types are obtained. On the basis of this analysis the conclusion is arrived at that it is inadvisable to use a circuit with series-connected phase control winding.

621.375.3

7838 USING TRANSISTORS TO INCREASE THE EFFICIENCY OF REVERSIBLE D.C. MAGNETIC AMPLIFIERS. M.A.Rozenblat and G.V.Subbotina.

Avtomat. i Telemekh., Vol. 20, No. 9, 1268-73 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 9, 1235-9 (Sept., 1959; publ. May, 1960).

A new circuit for a push-pull magnetic amplifier with d.c. load is described, high efficiency being obtained by the use of transistors as switches which permits the harmful effects of the halves of the circuit on each other to be practically eliminated. Results are given of investigation of a magnetic–semi-conductor amplifier built in accordance with the circuit presented, and data are also given for a high-stability measuring amplifier constructed on the same basis.

621.375.3

7839 INVESTIGATION OF THE OPERATION OF A MAGNETIC AMPLIFIER WITH SELF-SATURATION ON A THREE-PHASE LOAD. A.L.Pisarev.

Avtomat. i Telemekh., Vol. 20., No. 9, 1274-88 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 9, 1240-53 (Sept. 1959; publ. May, 1960).

The steady-state operation is considered for a magnetic amplifier with self-saturation operating on an active three-phase load for amplifiers with free and with suppressed a.c. components in the control windings. Methods are given for constructing the control characteristics, and the question of the voltage on the rectifiers is considered for both cases.

621.375.3

7840 CHOOSING FLEXIBLE FEEDBACK PARAMETERS FOR MAGNETIC AMPLIFIERS BY MEANS OF INTEGRAL ESTIMATES. L.V.Safris.

Avtomat. i Telemekh., Vol. 20, No. 10, 1392-1402 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 10, 1359-68 (Oct., 1959: publ. June, 1960).

The effect of the parameters of a flexible (velocity) feedback on the duration of the transient response in a choke-coupled magnetic amplifier is determined by means of the method of integral quadratic estimates.

621.375.3

7841 THE USE OF MAGNETIC AMPLIFIERS IN INTEGRATING CIRCUITS. S.B.Negnevitskii.
Avtomat. i Telemekh., Vol. 20, No. 10, 1431-4 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 10, 1396-1400 (Oct., 1959: publ. June, 1960).

Two basic circuits employing magnetic amplifiers as integrators are considered. Approximate expressions are derived for the transfer functions of these amplifiers, both without the amplifier time-constant being taken into account, and with it. The disadvantages and advantages of integrating magnetic amplifiers are given.

621.375.3

7842 THE PRODUCTION OF RELAXATION OSCILLATIONS BY MAGNETIC AMPLIFIERS. V.J.Stefanov.
C.R. Acad. Bulg. Sci., Vol. 12, No. 1, 13-16 (Jan.-Feb., 1960). In German.

It is shown how amplifiers with more than 100% feedback may be used as oscillators. Simple formulae are deduced for calculating the period of oscillation and the conditions of self-excitation. The assumptions are made that the amplifier is fast-acting and that the core material has a rectangular hysteresis loop. Voltage changes across the capacitor are neglected during the transient process. S.C.Dunn

621.375.3

7843 ANALOG COMPUTER DESIGN OF MAGNETIC AMPLIFIERS. L.A.Gregory.
Proc. Nat. Electronics Conf., Vol. 15, 679-90 (1959).

Regardless of the mathematical approach used in the design of magnetic amplifiers, the multiple solution of several equations, some of which have nonlinear variables, is the cause of considerable time loss and error. The purpose of this treatise is to present certain fundamental techniques in the analogue solution of such equations in an effort to minimize time and error. The simultaneous solution of several equations involving common variables can be more quickly accomplished by substituting variable voltages as the counterpart of mathematical variables in these equations. The combination of these voltages according to mathematical rules can be read or recorded on any electrical measuring device and transformed back into original mathematical language to attain the desired design data.

621.375.3

7844 A CALCULATING METHOD OF OBTAINING THE MAGNETIC AMPLIFIER CONTROL CHARACTERISTICS USING THE FLUX RESETTING CHARACTERISTICS OF THE REACTOR CORE. K.Murakami and T.Kikuchi.
Technol. Rep. Tohoku Univ., Vol. 24, No. 1, 53-66 (1959).

The residual [saturated] inductance of the reactor winding reduces the available power output of a magnetic amplifier. The effect is calculated using linear approximations to the magnetization characteristic: an infinte inductance up to the saturation point Φ_0, and a constant slope $\tan\phi = fL_0$ above it. Charts of design parameters are plotted for a bi-phase connection. These can be used for either an ideal (vibrating contact), or for a selenium rectifier. Experiments with a grain-orientated Fe-Si core show good agreement with calculation. Z.A.A.Krajewski

621:375.3

7845 INSTABILITIES OF PUSH-PULL MAGNETIC AMPLIFIERS FEEDING THE FIELD OF AN ELECTRIC MACHINE. H.F.Storm.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 33-6 (1960) = Commun. and Electronics, No. 47 (March, 1960).

Instability may occur when two centre-tapped magnetic amplifiers are used to control a d.c. generator (amplidyne) with duodirectional output. Minute changes in amplifier control current may cause a change in the armature voltage from +50 to -50 due to interaction through the common control circuit or the common amplidyne control flux. Improved stability may be achieved either by increasing the control circuit external impedance or by attenuating the transformation of alternating voltages from one amplidyne field to another by means of a third field, a reactor in the centre-tapped lead or by various component changes. A.J.Ingels

621.375.3

7846 RECTIFIER UNBLOCKING FROM A GENERALIZED ANALYSIS OF SELF-SATURATING MAGNETIC AMPLIFIERS. H.C.Bourne and D.Nitzan.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 99-105 (1960) = Commun. and Electronics, No. 48 (May, 1960).

Two models are used which give linear relations for a general analysis. The combinations of an alternating square-wave gate supply with d.c. control and a sinusoidal gate supply with rectified sinusoidal control are examined. The difference equations giving steady-state and transient characteristics are first derived assuming no rectifier unblocking. On these characteristics the criteria for rectifier unblocking may be determined. The regions of unblocking, superimposed on a family of steady-state transfer characteristics may be calculated for various conditions and used to check analysis and design procedures. The quantitative effect of rectifier unblocking on the time-constant is discontinuous and consequently the concept of a time-constant is no longer very significant. Theoretically the increase of this constant due to unblocking can be found by replacing the effective value of resistance during periods when the rectifier is unblocked. S.C.Dunn

621.375.3 : 621.314.63

7847 BRIDGE RECTIFIERS WITH MAGNETICALLY COUPLED LOADS. O.G.Malkina.
Avtomat. i Telemekh., Vol. 20, No. 5, 648-56 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 5, 621-8 (May, 1959: publ. Feb., 1960).

It is shown that bridge rectifiers with a negative inductive coupling between their loads, which consist of large resistances, can be used for measuring the R and X components of an impedance Z. With suitable selection of parameters it is possible to obtain an independent measurement of R and X. As an example, current changes are examined in identical circuits and in circuits whose bridge a.c. diagonals are connected to impedances which differ from each other by a small quantity $j\Delta x$.

621.375.4

7848 SURVEY OF NON-LINEAR DISTORTIONS, INCLUDING CROSS-MODULATION, IN TRANSISTOR STAGES. H.Lotsch.
Arch. elekt. Übertragung, Vol. 14, No. 5, 204-16 (May, 1960). In German.

A non-linear transfer characteristic is approximated by the first few terms of the Taylor expansion, and expressions are derived for the amplitudes of harmonics and cross-modulation products. The dependence of distortion on the working point and internal resistance of a grounded emitter stage is analysed. It is shown that distortion disappears at a particular working point. Cross-modulation is discussed on the basis of the derived expressions. Reduction of cross-modulation by means of pre-distortion or counter-modulation is described. The derived expressions are strictly valid only in the lower frequency range, and only a general discussion is given of the effects occurring at higher frequencies. J.M.Silberstein

621.375.4

7849 NEGATIVE-RESISTANCE AMPLIFIER DESIGN. J.B.Schultz and H.B.Yin.
Electronics, Vol. 33, No. 22, 110-12 (May 27, 1960).

The operation, equations relating gain, gain–bandwidth product, and conditions for stable amplification of both voltage-controlled resistive elements with N-shaped characteristics (e.g. tunnel diodes) and current-controlled elements with an S-shaped characteristics (e.g.four-layer transistor diodes) are discussed. Equivalent circuits for lowpass and bandpass amplifiers are given together with data enabling stability to be predicted. It is shown that both these types of amplifier have the same gain–bandwidth product. Typical experimental amplifiers have 12.5 dB gain with a cut-off frequency of 85 Mc/s for the lowpass amplifier and 28 dB with 4.6 Mc/s bandwidth for the bandpass case. Extreme care must be exercised when constructing amplifiers to avoid stray reactances and u.h.f. techniques must be used. A.P.C.Thiele

621.375.4

7850 TRANSISTORIZED DATA AMPLIFIER HAS HIGH GAIN-STABILITY. F.Offner.
Electronics, Vol. 33, No. 27, 55-7 (July 1, 1960).

The use of transistors in high-accuracy d.c. amplifiers poses a special problem due to temperature variations of leakage current, current gain and base–emitter voltage. A circuit is described which substantially eliminates the effect of all three parameter changes on transistor operating point. It also eliminates initial switching transients, greatly reduces ripple and gives extremely constant gain. A circuit diagram and performance figures of a complete transistorized amplifier are also given. M.Goldberg

621.375.4

7851 AMPLIFIER COMPENSATES FOR SPEECH-LEVEL VARIATIONS. L.E.Getgen.
Electronics, Vol. 33, No. 31, 103-6 (July 29, 1960).

This amplifier provides compensation by shifting the whole of the dynamic range of the individual speaker and does not clip signal peaks. It is largely immune from noise and tones by the inclusion of a 1.2 kc/s filter and a "syllabic" filter tuned to 7 c/s in the control circuits. A "proportional" control network ensures suitable gain increase depending upon the input signal–noise ratio. The heart of the control system is the "variolosser", a network made up of resistors and diodes. The system embodies 18 transistors and the power requirement is 200 mA at 48 V. H.G.M.Spratt

621.375.4

7852 HIGH INPUT IMPEDANCE TRANSISTOR CIRCUITS. I.Levine.
Electronics, Vol. 33, No. 36, 50-1 (Sept. 2, 1960).

Describes a three-stage feedback amplifier which, with silicon transistors, has a minimum input impedance of 50 MΩ and a maximum noise level of 750 μV r.m.s. (referred to the input) over the temperature range −50° to +100°C. Discusses briefly the four types of semiconductor noise and their effect upon amplifier design. D.J.Truslove

621.375.4 : 621.397.62

7853 A TRANSISTOR TV I.-F. AMPLIFIER. J.G.Humphrey.
I.R.E. Trans Broadcast and Televis. Receivers, Vol. BTR-6, No. 1, 17-20 (May, 1960).

The unit consists of three amplifying stages proper together with the detector and a video emitter-follower stage. A.G.C., providing a 40 dB range of control, is applied to the first stage only. A double-tuned input circuit is provided: all interstage networks are single-tuned. All stages are neutralized. The circuit diagram, and the a.g.c. and selectivity characteristics are given. H.G.M.Spratt

621.375.4

7854 A SOLID-STATE VIDEO PROCESSOR WITH PULSE-FOR-PULSE A.G.C. R.E.Segal.
I.R.E. WESCON Convention Record, Vol. 4, Pt 2, 35-42 (1960).

This unit is a wideband video amplifier designed to receive an i.f. amplifier output ranging in amplitude from signals barely discernible in the noise to at least 30 dB above that level. Output pulses which have a limited two-volt output and a width equal to the 50% width of the input are produced. Input pulses have poor rise and fall times and therefore large inputs would be stretched considerably if a system of pulse-for-pulse a.g.c. were not used. The video processor preserves the delay and width information over a large dynamic range by effectively slicing out the centre portion of each pulse and processing this signal into a standard amplitude and shape. This action is performed on both the leading and trailing edges of each pulse using direct-coupled circuits. A discussion of the enhancing of the rise and fall times, Zener diode limiting, and the driving of long coaxial cables is included.

621.375.4

7855 A COMPACT TUNNEL-DIODE AMPLIFIER FOR ULTRA-HIGH FREQUENCIES. G.Schaffner.
I.R.E. WESCON Convention Record, Vol. 4, Pt 2, 86-93 (1960).

Describes a compact tunnel-diode amplifier for operation between 405 and 460 Mc/s. Used in conjunction with an equally compact u.h.f. isolator, an unusually small, low-noise, and stable amplifier system is achieved. The design of the amplifier is described, including the effect of coupling on noise figure and stability. Special attention focused on the biasing circuit prevents low-frequency oscillation in the bias leads. The amplifier achieves a 15 dB gain, a 12 Mc/s bandwidth, and a noise figure of 5.5 dB across the band. With the isolator, system gain changes less than 3 dB with aerial v.s.w.r. variations of from 1.0 to 1.8 dB. Possible applications for the amplifier are discussed.

621.375.4

7856 SYNTHESIS OF MULTISTAGE FEEDBACK AMPLIFIER WITH INVERSE ROOT-LOCUS METHOD. Y.Fujimura.
J. Inst. Elect. Commun. Engrs Japan, Vol. 43, No. 5, 604-11 (May, 1960). In Japanese.

The inverse root-locus method, recently developed in the field of automatic-control-system synthesis, is here applied to the design of multistage feedback amplifiers. The inverse root-locus of the maximally-flat amplitude function is plotted and details are then given of the design of transistor video amplifiers with single-stage, 2-stage and 3-stage feedback, respectively. A.Wilkinson

621.375.4

7857 OPERATION OF AN ESAKI DIODE MICROWAVE AMPLIFIER. A.Yariv, J.S.Cook and P.E.Butzien.
Proc. Inst. Radio Engrs, Vol. 48, No. 6(I), 1155 (June, 1960).

A microwave amplifier using an Esaki diode and a three-port circulator has been operated at 4.5 Gc/s giving a stable gain of 23 dB, a bandwidth of 20 Mc/s, a noise figure of 7 dB and a power output of 1 μW. The diode peak current was 1.1 mA and the peak–valley ratio 2.5. J.MacCormack

621.375.4

7858 A TECHNIQUE FOR CASCADING TUNNEL-DIODE AMPLIFIERS. P.M.Chirlian.
Proc. Inst. Radio Engrs, Vol. 48, No. 6(I), 1156 (June, 1960).

A technique is suggested whereby negative resistances may be connected as elements of a transmission line in such a way that the input resistance is positive and the circuit stable. The technique suggested is intended to produce gains in excess of that obtained from a single stage two-terminal negative resistance amplifier whose gain has to be limited by stability requirements. A possible method of using Esaki diodes in such a configuration is described but no practical evidence is given and no mention is made of difficulties necessarily involved with each biasing-circuit stability problem. J.MacCormack

621.375.4

7859 ABSOLUTELY STABLE HYBRID COUPLED TUNNEL-DIODE AMPLIFIER. J.J.Sie.
Proc. Inst. Radio Engrs., Vol. 48, No. 7, 1321 (July, 1960).

The amplifier uses two matched tunnel diodes and a quarter-wave stripline coupled hybrid. It has a gain of about 8 dB over 200-600 Mc/s, a noise figure of about 2 dB, and an input v.s.w.r. of less than 2. F.F.Roberts

621.375.4

7860 NOISE OF MEASURE OF LOSSY TUNNEL DIODE AMPLIFIERS. A. van der Ziel.
Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1321 (July, 1960).

By comparing two equivalent circuit representations of the amplifier, a simple expression is obtained for the noise measure M of the amplifier. Because of the losses in the circuit, M increases with frequency, becoming infinite at the frequency above which the circuit ceases to operate as a negative resistance amplifier. F.F.Roberts

621.375.4

7861 TRANSISTORIZED LINEAR AMPLIFIER. S.F.Pinasco.
Rev. Electrotec., Vol. 46, No. 6, 209-11 (June, 1960). In Spanish.

The performance of a transistorized linear amplifier dealing with negative pulses at the input and the same polarity at the output is described. Linearity for output pulses is quoted as within 1% for pulses with up to 10V amplitude and the amplifier is said to have 3 dB drop in frequency-response curve at 700 kc/s. Only a modest attempt has been made to describe the method of stabilization of the quiescent working point of the transistors used, with stress on the reduction of influence of I_{CO} current. P-N-P and n-p-n transistors are used in the grounded-emitter configuration throughout. Three references. S.A.Kemura

621.375.4

7862 GRAPHICO-ANALYTICAL METHOD OF DESIGNING TRANSISTORIZED LOW FREQUENCY AMPLIFIERS. N.S.Nikolenko.
Radiotekhnika, Vol. 15, No. 7, 51-9 (July, 1960). In Russian.

Amplifier design can be undertaken, once current gain, input resistance and output load are known. The equivalent T-element network is discussed for the general cases of common emitter and common collector, and the analysis is then extended to multistage amplifiers with direct, RC, and transformer coupling. The case of a class-A amplifier with resistive load is discussed in detail and illustrated by curves of β, R_{in} and power gain versus I_C, with R_{load} as parameter, and of class-B push-pull amplifier. An experimental set up is also described, enabling the accurate plotting of transistor characteristics at 1 kc/s. A.Landman

621.375.4

7863 THE "DIRECTOR" INTERCOMM - SETS. R.Bayer and H.U.Knauer.
S.E.L. Nachr., Vol. 8, No. 1, 20-3 (1960). In German.

A newly developed series of transistorized push-button office intercommunication sets is described. A small loudspeaker is used as a reversible transducer, the whole unit being housed in a small well styled moulded case. The internal assembly and circuits are given. M.L.Gayford

621.375.4

7864 STABLE TRANSISTOR WIDE-BAND D.C. AMPLIFIERS. R.H.Okada.
Trans Amer. Inst. Elect. Engrs III, Vol. 79, 26-33 (1960) = Commun. and Electronics, No. 47 (March, 1960).

D.C.-drift in transistor amplifiers is mainly due to temperature variations of V_{be}. This can be reduced by non-linear elements, differential amplifiers (Slaughter), chopper amplifiers (Goldberg) and their combinations. These types are analysed and practical design methods given. A drift of less than 0.5 mV is attainable and this figure can be improved by selecting matched V_{be} temperature characteristics for the differential amplifier. A.Sczaniecki

621.375.4 : 621.317.39

7865 A CARRIER-FREQUENCY TRANSISTOR AMPLIFIER FOR ELECTRIC MICRO-WEIGHING AND OTHER MEASUREMENT APPLICATIONS. T.Gast.
Z. InstrumKde., Vol. 68, No. 2, 30-4 (Feb., 1960). In German.

The apparatus consists of a 500 kc/s oscillator, an r.f. amplifier, phase-sensitive rectifier, phase-shifter (90°), and a push-pull d.c. amplifier. The electrical part of the weighing balance consists of a moving-coil which is carried on the beam, and a fixed field coil which is wound on a transversely magnetized Ferroxdure core and forms the inductive part of the LC circuit of the oscillator. When the moving-coil is deflected by movement of the balance beam, an r.f. voltage is induced in it and is amplified and applied to the phase-sensitive rectifier. The resulting d.c. is amplified and fed back to the moving-coil and the direction and magnitude of the current are such that the beam is restored to its null position. A suitably calibrated d.c. milliammeter in series with the coil indicates the weight. The micro-balance is intended for weighing atmospheric dust deposits. It is stated that by employing high constructional standards, and by thermostatic control of the balance room, and with a working force of 1 g, a zero stability of 10^{-7} g is attainable. C.F.Pizzey

621.375.4 : 621.395.6

CHANGES IN TELEPHONIC AND ELECTRO-ACOUSTIC EQUIPMENT. See Abstr. 6894

621.375.4 : 621.316.72

THEORY OF CURRENT AND VOLTAGE STABILIZATION IN SINGLE-STAGE TRANSISTOR AMPLIFIERS. See Abstr. 7320

621.375.427

7866 ANALYTICAL DESIGN OF TRANSISTOR PUSH-PULL AMPLIFIERS. R.H.Riggs.
Electronics, Vol. 33, No. 24, 60-2 (June 10, 1960).

A common-emitter transformer-coupled push-pull amplifier is used to develop the rigorous mathematical expressions for the current and voltage relations in a transistorized output stage. Using this, the exact equations are given for the evaluation of the maximum output power, power gain and efficiency of the stage. The design of the bias circuit yields the relationship of the bias resistors which also give the adequate stability factor for the expected thermal conditions. A numerical example illustrates the application of the derived equations and the comparison between the calculated and measured values shows a discrepancy of about 9% or less. Five references. S.A.Kemura.

621.375.43

7867 CIRCUIT ANALYSIS OF FEEDBACK TRANSISTOR AMPLIFIERS. A.E.Ferguson.
Proc. Instn Radio Engrs Australia, Vol. 21, No. 6, 394-7 (June, 1960).

Methods of analysing transistor feedback amplifiers are examined. It is shown that the classical division of the amplifier into a forward and feedback network is frequently difficult to represent. The use of superposition, current node summation and virtual "zero current mesh" are discussed with examples. No attempt is made to catalogue possible feedback circuits but four fundamental connections are discussed.

621.375.432

7868 BROAD-BAND NEUTRALIZATION IN TRANSISTOR AMPLIFIERS. L.Gohm.
Elektronik, Vol. 9, No. 5, 149-52 (May, 1960). In German.

Generalized expressions for the necessary conditions are given, with equivalent circuits, for amplifiers with parallel, series–parallel, and parallel–series neutralization. A method of determining the parameters of the neutralizing network with aid of locus curves is described. W.G.Stripp

621.375.432

7869 TRANSISTOR FEEDBACK AMPLIFIERS. I-II. E.R.Hauri.
Tech. Mitt. P.T.T., Vol. 38, No. 6, 185-200; No. 7, 228-35 (1960). In German.

An analysis is given of the properties of negative feedback transistor amplifiers in terms of h-parameters. The four general methods of applying feedback, using resistive networks, and combined feedback arrangements, with their properties, are also discussed. Diagrams of various single and multiple stage feedback amplifiers are then given, including circuits having high input impedances and others in which the feedback is frequency-dependent. Precautions against instability are briefly outlined. T.H.D.Attewell

621.375.9 : 538.56

7870 MOLECULAR AND ALLIED DEVICES FOR GENERATION AND AMPLIFICATION OF MICROWAVES. S.Deb and A.N.Daw.
J. sci. industr. Res., Vol. 18A, No. 11, 510-19 (Nov., 1959).

Recent developments are briefly reviewed. Simple expositions of the principle of operation and representative experimental arrangements of Maser and Mavar devices are given. The possibilities of developing devices using plasma interaction and Cherenkov radiation are also briefly outlined. The relative advantages and disadvantages of various class of device and their present state of development are critically discussed.

621.375.9

7871 OPTICAL MASER ACTION IN RUBY. T.H.Maiman.
Brit. Commun. and Electronics, Vol. 7, No. 9, 674-5 (Sept., 1960).

The energy level considerations for stimulated oscillations between a doublet level (R_1R_2) and ground level in a 0.05% ($Cr_2O_3Al_2O_3$) ruby crystal are discussed. Oscillations at a frequency of 6943 A were observed using a crystal with two opposite faces silvered, apart from a small area through which the fluorescent radiation could be observed. The composite decay time of both R_1 and R_2 with increasing exciting pulse intensity was then measured. At low power levels, the decay was exponential with a decay time of 3.8 ms whereas at high power it was 0.6 ms and not exponential. From this reduction in decay time from its spontaneous value, it was inferred that stimulated emission was occurring, the peak power of the oscillations being estimated at 10 kW. Spectrographic analysis shows that the two levels R_1 and R_2 are affected very differently and hence it may also be possible to generate energy at their difference frequency of 870 Gc/s. A.P.C.Thiele

621.375.9

7872 NEGATIVE L AND C IN SOLID-STATE MASERS. R.L.Kyhl.
Proc. Inst. Radio Engrs, Vol. 48, No. 6 (1), 1157 (June, 1960).

It is shown that the population inversion in a maser can be regarded as a negative inductance and capacitance. Using this equivalent network a method of broadbanding a maser using two coupled cavities is described. The normal capacitance and inductance of the first are used to compensate the reactance of the second (which contains the paramagnetic salt) and thus increase the bandwidth. An expression is given for the gain–bandwidth product of such a device. A.P.C.Thiele

621.375.9

7873 AN ELECTROSTATICALLY FOCUSED ELECTRON BEAM PARAMETRIC AMPLIFIER. B.J.Udelson.
Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1485-6 (Aug., 1960).

A periodically focussed sheet beam has a natural transverse resonant frequency; gain is achieved in the pump section of the amplifier by superimposing a field of approximately twice this frequency. The design of balanced input and output r.f. couplers is discussed. Estimates of practical dimensions and voltages are

given; the problem of varying the frequency and limitations on performance are also briefly discussed. B.Meltzer

621.375.9

7874 PARAMETRIC AMPLIFICATION WITH SOLID STATE MATERIAL AND WITH ELECTRON BEAMS. G.Wade.
Proc. Nat. Electronics Conf., Vol. 15, 46-57 (1959).

Summarizes the characteristics and attainments of solid-state and electron-beam parametric amplifiers.

621.375.9

7875 RECENT ADVANCES IN ELECTRON BEAM PARAMETRIC AMPLIFIERS. R.Adler.
Proc. Nat. Electronics Conf., Vol. 15, 58-64 (1959).

Electron beam parametric amplifiers take advantage of a previously unused property of the fast wave carried by an electron stream. This property enables an external circuit to extract the beam noise while impressing a signal upon the stream. The resulting electron motion is then increased by the action of a non-homogeneous pumping field. The unilateral nature of the electron motion renders such amplifiers unconditionally stable and causes their bandwidth to be independent of gain. Experimental tubes are described and recent results given. Excess noise temperatures as low as 20° K have been measured. While the original models operated in the u.h.f. band, experimental tubes are now working at thousands of megacycles, and it appears that 10% bandwidth will be possible at these frequencies. A discussion of idler effects and the possibility of removing these effects is given.

621.375.9

7876 THE ENERGY BALANCE IN A PARAMETRIC ELECTRON BEAM AMPLIFIER. G.K.Grau.
Arch. elekt. Übertragung, Vol. 14, No. 6, 247-55 (June, 1960).
In German.

General energy relationships for the longitudinal parametric amplifier are derived from fundamental electron-flow equations by using a double Fourier series for beam and field parameters. Even when non-linearities are taken into account, d.c. energy flow can be treated separately from the a.c. mean energy flow. The principle of conservation of a.c. energy is expressed by two equations which represent the general energy relationships for the electron beam and correspond to the Manley–Rowe relations for the kinetic powers in the beam at the signal and idler frequency. When an electron beam is excited with n frequencies, the energy theorem is equivalent to a system of n + 1 equations, viz. the theorem of conservation of the d.c. energy and n Manley–Rowe relations.
J.M.Silberstein

621.375.9

7877 OSCILLATORY CIRCUITS WITH VARIABLE PARAMETERS (RHEOLINEAR OSCILLATORS). E.G.Woschni.
Hochfrequenztech. u. ElektAkust., Vol. 69, No. 3, 103-8 (June, 1960).
In German.

Starting from known results obtained using Hill's and Mathieu's equations, approximate formulae are derived for the pulling range and negative damping of circuits in which the capacitance is varied sinusoidally. By using a special transformation the analogous problem with variable damping may be solved in the same form. The relation between pulling range and negative damping is deduced and shown to apply to other, higher, orders of behaviour.
S.C.Dunn

621.375.9

7878 DESIGN AND OPERATION OF AN S-BAND TRAVELING-WAVE DIODE PARAMETRIC AMPLIFIER. C.G.Shafer.
I.R.E. WESCON Convention Record, Vol. 4, Pt 1, 49-54 (1960).

Design principles were obtained by employing a coupled-mode approach, which is similar to that used in travelling-wave tube design. This theoretical approach is illustrated by deriving the gain formula for the amplifier. Other results of this theoretical investigation are briefly discussed and listed. The amplifier possesses the following performance characteristics: frequency range 3240-3400 Mc/s; forward gain/diode ~1.0 dB; pump power (for four diodes): 400 mW; pump frequency 6600 Mc/s; reverse loss/diode ~0.25 dB. The problems involved in the design of the amplifier are discussed.

621.375.9

7879 GAIN AND BANDWIDTH INCONSISTENCIES IN LOW FREQUENCY REACTANCE UP-CONVERTER PARAMETRIC AMPLIFIERS. A.K.Kamal and A.J.Holub.
I.R.E. WESCON Convention Record, Vol. 4, Pt 2, 80-85 (1960).

A first-order explanation is presented by showing that a parameter α, which is an important factor in the gain equation, has to be equal to unity to give the theoretical gain. At low frequencies, however, this condition is very difficult to realize in practice. The bandwidth is shown to be less than that predicted by others, when the factor α is not unity. The noise figure does not seem to be affected. An experimental amplifier is described and the above results are verified which show complete agreement.

621.375.9

7880 LOWER FREQUENCY PUMPING ELECTRON BEAM PARAMETRIC AMPLIFIER. N.B.Chakraborti.
J. Electronics and Control, Vol. 8, No. 3, 161-5 (March, 1960).

A brief analysis of the space-charge wave type of amplifier (Louisell, 1959). Gain may be obtained when either the magnitude of the second harmonic of the pump is sufficient or when two pumps are employed to modulate the beam to different extents.
A.H.W.Beck

621.375.9 : 621.396.67

7881 PARAMETRIC AMPLIFIER ANTENNA. A.D.Frost.
Proc. Inst. Radio Engrs, Vol. 48, No. 6(I), 1163-4 (June, 1960).

The form of parametric amplifier described by Harris [CQ - The Radio Amateur Journal, Vol. 14, No. 11, 74-6, 159, 164, 168 (Nov., 1958)] has been modified into a balanced form which can be incorporated within a half-wave dipole. Experimental data are quoted showing gains of up to 23 dB over a simple dipole. W.T.Blackband

621.375.9

7882 SINGLE-DIODE PARAMETRIC UP-CONVERTER WITH LARGE GAIN-BANDWIDTH PRODUCT. R.Pettai, B.Bossard and S.Weissbaum.
Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1323-4 (July, 1960).

A voltage gain-bandwidth product of 41.1% has been obtained with a noise figure < 3dB operating at a signal frequency of approx. 1000 Mc/s pumped at approx. 10 000 Mc/s. In order to reduce frequency sensitivity the diode is mounted in a section of uniform waveguide, waveguide filters being used to pass or exclude pump or idler powers in the appropriate directions. Using a combination of theoretical analysis with experiment the diode self-admittances were effectively tuned out over the operating band using multiple cavity networks. Operation at 700 Mc/s and at 2000 Mc/s has been achieved also with slight adjustments in tuning.
G.D.Sims

621.375.9

7883 OPTIMUM NOISE PERFORMANCE OF PARAMETRIC AMPLIFIERS. K.L.Kotzebue.
Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1324-5 (July, 1960).

A simplified discussion of the noise figures of various arrangements using a semiconductor diode in a resonant cavity, including various sources of loss, is presented. A.H.W.Beck

621.375.9

7884 MILLIMETER WAVE GENERATION BY PARAMETRIC METHODS. G.H.Heilmeier.
Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1326-7 (July, 1960).

Brief discription of a gallium arsenide point-contact diode used as an up-convertor from 24-48 Gc/s. A conversion loss of only 9 dB was achieved A.H.W.Beck

621.375.9

7885 EFFECT OF A GENERATOR OR LOAD MISMATCH ON THE OPERATION OF A PARAMETRIC AMPLIFIER. K.M.Johnson.
Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1327-8 (July, 1960).

The operation of a parametric amplifier without a circulator or other non-reciprocal element is discussed. It is desirable, for low noise, to make the generator conductance much greater than the load conductance, and the influence of this condition on stability is investigated. A.H.W.Beck

621.375.9

7886 PARAMETRIC STANDING WAVE AMPLIFIERS. R.Landauer.

Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1328-9 (July, 1960).

A brief report of an investigation of parametric amplification on nonlinear transmission lines taking into account the distortion of the propagation of the pump signal by the nonlinearity of the system. A.H.W.Beck

621.375.9

7887 X-BAND SUPER-REGENERATIVE PARAMETRIC AMPLIFIER. B.B.Bossard, E.Frost and W.Fishbein.

Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1329-30 (July, 1960).

An X-band super-regenerative parametric amplifier based on a varactor with a cut-off of only 41 Gc/s is described. The gain was 50 dB and the bandwidth 2.4 Mc/s. A.H.W.Beck

621.375.9

7888 THE EFFECT OF PARASITIC DIODE ELEMENTS ON TRAVELING-WAVE PARAMETRIC AMPLIFICATION. D.Fleri and J.Sie.

Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1330-1 (July, 1960).

Previous analysis of travelling-wave parametric devices represent the diode elements as ideal nonlinear capacitors periodically shunting the transmission line. Above u.h.f., series lead-inductance, shunt case-capacitance and dissipative junction losses must be included in a practical design formula. Design formulae are derived, the results of which have not been experimentally verified up to the present time. A.C.Brown

621.375.9

7889 A METHOD FOR BROAD-BANDING SYNCHRONISM IN TRAVELING-WAVE PARAMETRIC DEVICES. H.Boyet and D.Fleri.

Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1331-3 (July, 1960).

A theoretical method for achieving very broadband synchronism between signal, idler, and pump waves in a parametric-diode travelling-wave amplifier or up-converter is described. Explicit equations giving the values of diode parameters and idler frequency needed to achieve the broadbanding synchronism are derived. This method is compared to that assuming negligible series inductance and found to be superior in terms of synchronism, gain and bandwidth. A.C.Brown

621.375.9

7890 A PARAMETRIC DEVICE AS A NONRECIPROCAL ELEMENT. A.K.Kamal.

Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1424-30 (Aug., 1960).

A parametric device is proposed which is equivalent to a passive nonreciprocal phase-shifter. A first-order analysis is made assuming the series resistance effect in the variable capacitance diode to be negligible and a dispersion theory for matching and bandwidth of the nonreciprocal element is developed. The nonreciprocal phase behaviour of the device was exhibited experimentally over a narrow frequency band.

621.375.9

7891 OPTIMUM NOISE AND GAIN–BANDWIDTH PERFORMANCE FOR A PRACTICAL ONE-PORT PARAMETRIC AMPLIFIER. J.C.Greene and E.W.Sard.

Proc. Inst. Radio Engrs, Vol. 48, No. 9, 1583-90 (Sept., 1960).

A practical one-port parametric amplifier is analysed to determine the conditions under which minimum effective noise temperature and maximum gain–bandwidth product can be obtained. The analysis considers the effects of resistive loss and stray parasitic reactance in the junction diode that provides the essential nonlinear reactance. It is shown that the conditions necessary for minimum noise temperature are compatible with those necessary for maximum gain–bandwidth product only if the diode has a high self-resonant frequency (the frequency at which the average diode capacitance resonates with the diode lead inductance). It is also shown that minimum noise temperature is always achieved when the diode loss alone is used as the idler circuit loading (regardless of the temperature of any additional idler loading), that there is a characteristic figure of merit for the diode, and that there is an optimum pump frequency. Based on the equations derived, universal curves are drawn that permit the design of an optimum amplifier when the signal frequency and diode characteristics are specified. In conclusion, it is shown that if junction-diode parametric amplifiers operated at room temperature are to seriously challenge the low-noise performance of the maser at microwave frequencies, a substantial improvement in the diode figure of merit is required.

621.375.9

7892 SYMMETRICAL MATRIX ANALYSIS OF PARAMETRIC AMPLIFIERS AND CONVERTERS. S.Deutsch.

Proc. Inst. Radio Engrs, Vol. 48, No. 9, 1595-602 (Sept., 1960).

It is shown that the parametric amplifier and frequency convertor can be described by four equations whose coefficients form a matrix that is symmetrical. Because of this symmetry, the calculations for gain, bandwidth, and noise figure yield simple and manageable results. By regarding the matrix as a nodal admittance array, an equivalent conductance circuit is constructed. The derived expressions show that, for low noise figure, the idle-frequency should be much higher than the signal-frequency. This is also the requirement for wide bandwidth. Numerical examples of amplifier and convertor design are given.

621.375.9

7893 MAGNETIC FILM PARAMETRIC AMPLIFIERS. A.A.Read and A.V.Pohm.

Proc. Nat. Electronics Conf., Vol. 15, 65-78 (1959).

The recent development of practical nonlinear low-loss reactance elements has created an ever increasing interest in parametric amplification. To date the majority of these have been capacitive elements obtained by using the transition region in back-biased junction diodes. Only a limited consideration has been given to inductive elements, and then mostly to elements containing ferrites. The authors have used inductive elements made from thin ferromagnetic films similar to those being used for computer memories. An experimental parametric amplifier has been constructed having a pump frequency in the 20 to 30 Mc/s range. Signal gains in the 20 dB range were obtained as well as super-regenerative detection of very low level signals. Thin-film parametric amplification is discussed both graphically and analytically in terms of a quasi-static model. At frequencies below v.h.f. this is satisfactory. At higher frequencies a model with losses must be considered. Such a model indicates that operation up to 1000 Mc/s or higher should be feasible with moderate pumping powers.

621.375.9

7894 PARAMETRIC AMPLIFICATION WITH SEMICONDUCTOR DIODES. E.L.Steele.

Proc. Nat. Electronics Conf., Vol. 15, 566-74 (1959).

The role of the semiconductor diode as a variable capacitance element is evaluated by examining the circuit behaviour of simple configurations. An analysis of a series resonant circuit as a parametric amplifier is presented. The important properties of the variable capacitance element in oscillator and amplifier applications are evaluated. The analysis and description are then extended to the coupled resonant circuit where the role of the idler circuit is analysed. The coupling element used is the variable capacitance to the semiconductor diode. The effect of the idler circuit on the phase and magnitude of the feedback current is shown, and a detailed comparison with conventional feedback amplifier parameters is made. The role of electrical Q of the diode element, operating frequencies, size of the capacitance, and capacitance swing is calculated.

MODULATION . DEMODULATION

621.376

7895 COMPARISON OF MODULATION SYSTEMS FOR SPEECH COMMUNICATION. I.Wigdorovits.

Brown Boveri Rev., Vol. 46, No. 11-12, 629-43 (Nov.-Dec., 1959).

Four modulation systems used for the transmission of speech by radio are studied from the theoretical aspect and the main properties of speech utilized to enable full advantage to be taken of the capacity of the communication system. The signal-to-noise ratio and the syllable articulation are calculated in terms of the r.f. signal power available at the receiving aerial, special attention being devoted to those cases where the speech amplitude is severely clipped. Another method of comparing the various modulation systems, based on the utilization factor and derived from the well-known laws of information theory, is described. Finally, external

disturbances and their influence on different modulation systems are dealt with qualitatively.

621.376.2

7896 ANALYSIS OF AMPLITUDE–PHASE MODULATION SPECTRA. L.E.Klyagin.

Radiotekhnika, Vol. 15, No. 8, 67-73 (Aug., 1960). In Russian.

Obtains formulae that indicate the quality of the modulated signal at the output of a Kahn type transmitter (Abstr. 3227 of 1958). This, like the square modulation circuit, cannot be recommended for practical use. The formulae hold when the amplitude modulator and phase modulation amplifier introduce no frequency or phase distortion. If these conditions are not fulfilled the second side-band suppression can only be worse. See also the analysis of a somewhat modified Kahn circuit by Costas (Abstr. 5563 of 1958).

D.E.Brown

621.376.23

7897 ANALYSIS OF A DIODE DETECTOR AS A VARIABLE PARAMETER DEVICE. J.Lenkowski.

Arch. elektrotech. (Warsaw), Vol. 8, No. 1, 123-31 (1959). In Polish.

The diode detector is treated as a circuit of periodically variable conductance. The ensuing differential equation is solved by the perturbation method of Shelkunoff [Quart. appl. Math., Vol. 3, No. 4, 348 (1946)]. Results are consistent with those obtained in a different way by Haantjes and Tellegen (Abstr. 2651 of 1948).

A.Sczaniecki

621.376.23

7898 TRANSIENT RESPONSE AND FREQUENCY CHARACTERISTIC OF DIFFERENTIAL PHASE-SENSITIVE DETECTORS WITH RHEOSTAT-CAPACITIVE LOADS. V.I.Anisimov.

Avtomat. i Telemekh., Vol. 20, No. 6, 784-92 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 6, 759-67 (June, 1959: publ. Feb., 1960).

A method is considered for computing the transient response and frequency characteristics of differential phase-sensitive detectors with rheostat-capacitive loads. An equivalent circuit to the detectors is given and the pulsation coefficient of the output voltage is computed.

621.376.23 : 621.385.624

7899 USE OF REFLEX KLYSTRONS AS MILLIMETER WAVE DETECTORS. K.Ishii.

Electronics, Vol. 33, No. 37, 82-3 (Sept. 9, 1960).

By adjusting the repeller voltage to a value which allows some electrons to reach it, a reflex klystron can be used as a detector. Experiments carried out at 58 Gc/s are described. The signal was square-wave modulated at 1 kc/s, and the detected output at the reflector terminal measured. An out 12 dB greater than that from a matched crystal was obtained.

E.A.Ash

621.376.239

7900 THE USE OF HALL-ELEMENTS AS PHASE-SENSITIVE DETECTORS. V.N.Bogomolov and V.A.Myasnikov.

Avtomat. i Telemekh., Vol. 20, No. 6, 799-807 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 6, 774-82 (June, 1959: publ. Feb., 1960).

The operation of a phase-sensitive detector based on the Hall effect is considered, and certain basic relationships are provided. A simple graphical method is presented for choosing elements to compensate for the temperature dependence of the Hall-element parameters. A table of experimental data for three different phase-sensitive detectors is given.

621.376.239 : 536.3

7901 SYNCHRONOUS THERMAL DETECTOR. J.P.Borel and P.Cornaz.

Z. angew. Math. Phys., Vol. 11, No. 2, 89-101 (March 25, 1960). In French.

Describes various types of phase-sensitive detector which depend in principle, upon the heating of resistances through which flow simultaneously a signal current I_S and a reference current I_T of frequency ω. If the signal current has the same frequency ω as the reference current then the average heating is higher by $I_S I_T \cos\phi$ than when the signal and reference current have different frequencies. The temperature difference is measured in a bridge circuit of thermal elements, metal resistances or thermistors. The special advantages of the detector are: (1) simplicity; (2) robustness; (3) small dimensions; (4) functional reliability; (5) long life; and (6) inherent time-constant from 0.2 sec to 100 sec at will. In the case of types with metal resistances, the working point is such that the output voltage is independent of the magnitude of the reference current I . See also Abstr. 347 of 1952.

621.376.3

7902 EXPLICIT FORM OF F.M. DISTORTION PRODUCTS WITH WHITE-NOISE MODULATION. (EXTENSION AND CORRECTION). R.G.Medhurst and J.H.Roberts.

Proc. Instn Elect. Engrs, Monogr. 352E, publ. Jan., 1960. (Vol. 107C, 367-9).

For abstract see Abstr. 866 of 1960.

621.376.32

7903 THE PROCESS OF ESTABLISHING THE FREQUENCY AT THE OUTPUT OF A NARROW-BAND IDEAL FILTER WITH FREQUENCY–PHASE MODULATION. L.I.Yaroslavskii and B.I.Yakhinson.

Radiotekhnika, Vol. 15, No. 7, 44-50 (July, 1960). In Russian.

Transient processes are considered, particularly the exact process of establishing the instantaneous frequency and the instantaneous amplitude at the output of a narrow-band system with frequency-phase modulation of the input, i.e. with simultaneous step change of its frequency and phase. Pure frequency- and pure phase-modulation are examined as a special case of frequency–phase modulation.

T.Horrocks

621.376.33 : 621.396.96

7904 THE OUTPUT SPECTRAL DENSITY OF A DETECTOR OPERATING ON A F.M. C.W. RADAR SIGNAL IN THE PRESENCE OF BAND-LIMITED WHITE NOISE. J.Lait and A.J.Hymans.

Proc. Instn Elect. Engrs, Monogr. 412 E, publ. Oct., 1960, 11 pp. To be republished in Part C.

A method of analysis suggested by Lawson and Uhlenbeck is used to examine the interaction between reference signal–echo and noise in the detector stage of a frequency-modulated c.w. radar receiver. A method of approximation is given which may be used in most practical cases and the restrictions on system parameters for which the approximations are valid, are stated. Expressions for spectral density are derived separately for both quadratic and linear detectors, and the question of optimum predetector bandwidth is examined. Finally, the authors consider how signal/noise ratio will be affected by choice of bandwidth in stages which follow the detector.

621.376.332 : 621.396

7905 AN IMPROVED F.M. DISCRIMINATOR–DETECTOR FOR AIRBORNE TELEMETRY RECEIVERS. G.E.Reis and C.E.Land.

I.R.E. WESCON Convention Record, Vol. 4, Pt 5, 162-73 (1960).

The problem of designing an f.m. receiver for airborne telemetering applications led to a critical evaluation of existing discriminator-detector circuits. Existing circuits were compared on the basis of efficiency, complexity in both design and construction, ease of adjustment, and adaptability to subminiature packaging techniques. This study led to the development of a new discriminator–detector circuit which has been incorporated in various package configurations and has given excellent performance under adverse environmental conditions. When evaluated, stressing points enumerated above, the circuit has proved to be superior to other circuits similarly evaluated. A qualitative description of the Snyder discriminator–detector circuit is presented. In an effort to serve the interests of the casual reader, mathematical derivations are religiously avoided in this portion of the paper. For the more curious, the subsequent circuit analysis is a rigorous quantitative description of the discriminator circuit. Anticipating an obvious comparison, the essential differences between the Snyder circuit and the Weiss discriminator are explained at the conclusion of the circuit analysis. The validity of the analysis is confirmed by comparison of theoretical predictions and experimental results for a typical circuit.

621.376.4 : 621.391

7906 AUDIO COMMUNICATION WITH ORTHOGONAL TIME FUNCTIONS. H.F.Harmuth

Proc. Instn Elect. Engrs, Monogr. 405 E, publ. Oct., 1960. To be republished in Part C.

An audio signal may be decomposed into components having

certain frequency and phase. Half the information of the signal is contained in the phase of the frequency components. Since the human ear is almost insentive to phase, one may eliminate the phase information without causing a noticeable reduction in the signal quality. The elimination of the phase information implies a permissible reduction of the bandwidth required for the transmission of the signal to one-half and a reduction of the signal power by 3 dB without increase of distortions due to additive white normal noise. A method for the elimination of the phase information is based on the decomposition of the audio signal by correlation with a set of orthogonal functions. These correlations yield for each orthogonal function one coefficient which is represented by a voltage. One may process these coefficients in analogue or digital computers to reduce further the bandwidth required for the transmission of audio signals with certain spectral distribution, e.g. voice signals.

621.376.4

7907 THE PHASE-SENSITIVE DETECTOR IN R.F. SPECTROSCOPY. W.Zeil and H.K.Bodenseh.
Z. InstrumKde, Vol. 68, No. 4, 76-81 (April, 1960). In German.

A short review on the development of the phase-sensitive detector in r.f.-spectroscopy is given. It is shown that in microwave spectroscopy an extremely small bandwidth in the amplifier system is necessary. The principles of the function of the phase-sensitive detector are discussed and its advantages — minimum bandwidth and the possibility of separating signals of different phases — are shown. Finally, the standard circuits are discussed, and a complete circuit for a frequency of 100 kc/s is described as an example.

621.376.5 : 621.396.96

7908 SOLID-STATE MODULATOR FEEDS SUBMINIATURE TRANSPONDER. L.Diven.
Electronics, Vol. 33, No. 27, 48-51 (July 1, 1960).

Developed as an integral light-weight unit for missile test firings, this C-band transponder features a semiconductor modulator whose fast switching time results in a r.f. output pulse with extremely fast rise and fall times. Delay stability with a.g.c. operation for a signal input range of 45 dB is such that 1 yard range accuracy in 200 miles is possible. Full circuit diagrams and description is given. A.Reiss

621.376.5

7909 DETECTION OF BINARY SIGNALS. H.Ekre.
Elektrotek. T., Vol. 73, No. 20, 329-41 (Aug. 15, 1960). In Norwegian.

The ideal diversity receiver for binary signals is formulated statistically. It is shown how this can be achieved by coherent detection or optimal filtering for both of which the detection functions are derived. The probability of element errors in the detection of Rayleigh-fading signals is calculated. It is shown how the probability of letter errors on a teleprinter communication system may be reduced by introducing feedback into the system. A set of graphs given provides a comparison between several different detection and diversity systems. G.N.J.Beck

621.376.533

7910 SOLID-STATE PULSE MODULATOR. W.H.Lob.
Electronics, Vol. 33, No. 30, 72, 74 (July 22, 1960).

The modulator is used to drive the transmitting valve of a beacon. It embodies silicon gated diodes which operate as switches and are triggered by a current pulse flowing from gate terminal to cathode. The pulse width ranges from 1 to 10 μs and the recovery time is less than 50 μs, far less than that of the thyratrons previously used. This rapid recovery is achieved by using a second gated diode as a switch to replace the charging choke of the conventional pulse modulator. A protective relay in series with the diodes disconnects the power supply momentarily in the case of runaway due to premature retriggering. The circuit is somewhat temperature-sensitive. H.G.M.Spratt

621.376.56

7911 P.C.M. SYSTEM TRENDS. R.L.Sink.
I.R.E. WESCON Convention Record, Vol. 4, Pt 5, 94-100 (1960).

A review of the characteristics of current p.c.m. systems is presented. The information contained from a study of currently used system characteristics enables the selection of a "most probable system". The "most probable system" is a composite system which has the characteristics most often used in current p.c.m. programmes. Based upon the "most probable system" characteristics and a review of earlier system designs, some predictions are made concerning p.c.m. requirements which may be appropriate for a multiplicity of applications within the next few years. Additionally, the characteristic parameters of such a system are established based upon the use of existing techniques.

621.376.56

7912 ON THE CONSTRUCTION OF TRANSMISSION PARAMETERS WITH OPTIMAL DECODING METHODS IN THE PRESENCE OF NON-ADDITIVE NOISE. B.S.Fleishman.
Radiotekhnika, Vol. 15, No. 8, 25-32 (Aug., 1960). In Russian.

The construction of a decoding system is described ensuring for certain defined kinds of modulation reliable transmission of a maximal number of significant parameters in the presence of non-additive noise. The possibility of practical realization of the results of the theoretical investigation is also considered. T.Horrocks

ELECTRONICS

SEMICONDUCTOR MATERIALS AND DEVICES

TRANSISTORS

621.382 : 621.317.44

7913 THE HALL EFFECT AND ITS TECHNICAL APPLICATION. II. BASIC TYPES AND APPLICATION FOR MAGNETIC-FIELD MEASUREMENT. E.Schwaibold.
Arch. tech. Messen, No. 296 (Ref. V 943-3), 185-6 (Sept., 1960).
For Pt I, see Abstr. 679 of 1957.

621.382

7914 PRINCIPLES AND APPLICATIONS OF HALL-EFFECT DEVICES. M.Epstein, L.J.Greenstein and H.M.Sachs.
Proc. Nat. Electronics Conf., Vol. 15, 241-52 (1959).

The Hall-effect and its utilization in engineering applications is described. Results of work performed on magnetic-field measurements employing Hall-effect devices are given. The development of semiconductor materials with high-mobility carriers and their use as Hall-effect sensors is discussed. Considerations and problems relative to design and construction of Hall-effect sensors are described. Results indicate that high sensitivities can be obtained; measurements of magnetic-field intensities of the order of 10^{-4} Oe, independent of frequency, were achieved. When used in conjunction with permeable materials, sensitivities of 10^{-9} Oe were obtained. The design and experimental results of an Armstrong phase-shift modulator are given. Utilization of the principle of multiplication inherent in Hall-effect devices, in the design of various communication circuits is indicated.

621.382

7915 NON-LINEAR PROPERTIES AND IONIC MIGRATION IN SILICON CARBIDE. R.Goffaux.
Rev. gen. Elect., Vol. 69, No. 6, 331-8 (June, 1960). In French.

Measurements were made of the conductivity of polycrystalline samples of SiC at temperatures between 300^{0} and 600^{0}K, and at frequencies from d.c. up to 100 kc/s. It is suggested that the observed effects are due to the migration of mobile ions in the intergranular barriers. C.Hilsum

621.382

7916 SPACE CHARGE CONDUCTION IN THE SEMICONDUCTOR UNIPOLAR JUNCTION (IV). NEW TYPE TRANSISTORS AND PHOTO DEVICES (I).

J.Nishizawa and Y.Watanabe.
Rep. Res. Inst. Elect. Commun. Tohoku Univ. B, Vol. 9, No. 2, 123-42 (1957).

Continues a detailed theoretical study of the current–voltage characteristics of p–i and p–ν junctions, including the effects of traps and of the spreading resistance. Some application to Cu_2O rectifiers is briefly mentioned, and some photoconductive phenomena are also considered. F.F.Roberts

621.382 : 621.319.339 : 537.54

THE ELECTRON VAN DE GRAAFF IN SEMICONDUCTOR RESEARCH. See Abstr. 7568

621.382.2

7917 THE PROTECTION OF A GERMANIUM DIODE FROM OVERVOLTAGES EXCITED ON SWITCHING.
V.Gusa, Ya.Tsigelka and L.Chernyi.
Elektrichestvo, 1960, No. 6, 82-5 (June). In Russian.

After briefly describing the physical nature of the "inertial" current in the diode, a circuit is analysed theoretically in which an alternating voltage is applied to a resistance R and inductance L in series with the diode, an R_pC_p series protective combination being in parallel with the diode. The diode is regarded as an RC parallel circuit (R_p is a function of time). The 3 cases $R \ll R_p$, $R = R_p$ and $R \gg R_p$ are worked out and the results verified experimentally at 50 c/s with $C_p = 1\ \mu f$; a graph shows relative diode voltage as a function of R_p. D.E.Brown

621.382.2

7918 OPTIMUM FIGURES OF MERIT OF VARACTORS.
H.G.Rudenberg.
Proc. Nat. Electronics Conf., Vol. 15, 79-82 (1959).

Semiconductor and ferroelectric voltage variable capacitors (varactors) have generally been characterized by their capacitance–voltage coefficient n and by their circuit Q at a given frequency f. As most circuit applications involve trimming or padding with low-loss capacitors, in can be shown that a low-Q varactor of large voltage coefficient can give results equivalent to a high-Q varactor of small voltage coefficient. Practical designs which maximize the $F = nQf$ product or figure of merit of diodes are described. These concepts lead to special diffused semiconductor designs having very high capacitance–voltage coefficients. A high figure of merit is achieved by different approaches in l.f. and v.h.f. circuits, depending on the circuit requirements for n, Q, and equivalent varactor series resistance. Design considerations provide useful silicon junction structures for low capacitance microwave parametric amplifier diodes, for audio-frequency modulators, and for intermediate ranges of frequencies. Some actual characteristics are described.

621.382.2

7919 A GOLD-BONDED GERMANIUM DIODE FOR PARAMETRIC AMPLIFICATION. S.T.Eng and W.P.Waters.
Proc. Nat. Electronics Conf., Vol. 15, 83-91(1959).

A gold-bonded germanium diode was developed with the required characteristics for use at microwave frequencies. These characteristics are: a zero-bias junction-capacitance of 2.5 $\mu\mu$F, a reverse voltage of at least 5 V and a frequency cut-off of 30 Gc/s or higher at operating bias; frequency cut-off ranges as high as 100 Gc/s at maximum reverse bias. The diode junction is hermetically sealed for ultimate stability of the characteristics. The diode can be used as a sub-harmonic oscillator for the operation of computers above a 100 Mc/s repetition rate, and eventually may be produced cheaply enough for use in low-noise television preamplifiers. For low-noise operation, this diode was used in a parametric amplifier at S-band to give a noise temperature of 100° K at room temperature. This diode is unique in that it can be cooled down to liquid-nitrogen temperatures, with net improvement in Q. Operating at 150° K, this diode, in the same amplifier, produced a noise temperature of 50° K.

621.382.2 : 621.395.345

THE P-N-P-N DIODE AS A CROSS-POINT FOR ELECTRONIC TELEPHONE EXCHANGES. See Abstr. 8122

621.382.2 : 621.373.5

U.H.F. HARMONIC GENERATION WITH SILICON DIODES. See Abstr. 7729

621.382.232

7920 BIASING METHODS FOR TUNNEL DIODES.
R.P.Murray.
Electronics, Vol. 33, 82-3 (June 3, 1960).

Arrangements for operation as a switch, amplifier or oscillator are described. C.Fromberg

621.382.232

7921 TUNNEL DIODES.
W.W.Gärtner.
Elektron. Rdsch, Vol. 14, No. 7, 265-71 (July, 1960). In German.

A well-presented review of the Esaki (tunnel) diode, including principles of operation, simplicity of design, multiplicity of application, extreme frequency coverage (including microwaves), high efficiency, independence of temperature variations and surface contaminations. It is pointed out however that the high shunt capacity, small output amplitude, tendency for oscillation and reciprocity of direction demand a basic departure from conventional circuitry. A.Sczaniecki

621.382.232 : 539.17

7922 USE OF SILICON P–N JUNCTION DETECTORS IN STUDIES OF NUCLEAR REACTIONS INDUCED BY HEAVY IONS. A.E.Larsh, G.E.Gordon and T.Sikkeland.
Rev. sci. Instrum., Vol. 31, No. 10, 1114-18 (Oct., 1960).

Experiments in which silicon p–n junctions have been used as detectors of fission fragments and elastically scattered heavy ions are described. The curve of pulse height versus energy for carbon particles is linear and passes through the origin. Points for Cf^{252} fission fragments and alpha particles fall on the curve determined by the carbon-particle points. This result implies that the energy required for electron-hole pair formation is the same for the three types of particles. Also, no "ionization defect" is observed for the fission fragments. Some other possible uses for the detectors of this type are suggested.

621.382.232

7923 THE TECHNOLOGICAL EFFECTS OF THE SHAPE OF P–N ALLOY JUNCTIONS. B.Mroziewicz.
Arch. elektrotech. (Warsaw), Vol. 8, No. 1, 169-200 (1959). In Polish.

The geometry of the alloyed junction has an important influence on the transistor parameters. Most satisfactory results have been obtained by introducing into the indium a metal head, which slows up the rate of solution of the germanium. The best plane orientation of the germanium wafer is [111]. Records of the experiments are described and a method of revealing the p–n junctions is given. A.Sczaniecki

621.382.233

7924 CONTROLLED SILICON RECTIFIERS. I.
Elektronik, Vol. 9, No. 7, 199-200 (July, 1960). In German.

The rectifiers have a "gate" electrode between anode and cathode, by means of which the firing point may be controlled as in grid-controlled thyratrons. A single-phase circuit with a phase-shifter feeding the gates is described. W.G.Stripp

621.382.3 : 621.372.632

7925 TRANSISTOR OPERATION BEYOND CUTOFF FREQUENCY. V.W.Vodicka and R.Zuleeg.
Electronics, Vol. 33, No. 35, 56-60 (Aug. 26, 1960).

Describes a new mode of operation of transistors as u.h.f. oscillators and frequency convertors taking advantage of the complex phase relationships between currents in feedback loops, whereby the undesirable capacitances are apparently removed by incorporating them into tuned elements. The frequency performance is thus limited by the transit time of minority carriers across the effective base width. Transistors have thus been operated with useful gains at frequencies 2-3 times their normal cut-off frequencies. A full analysis of the circuit is difficult, because it is the extreme changes in the nonlinear elements that are mainly responsible for the conversion properties. W.D.Gilmour

621.382.3

7926 THE USE OF THE SILICON RESISTOR IN THE D.C. STABILIZATION OF TRANSISTOR CIRCUITS.
D.H.Mehrtens and J.T.Zakrzewski.
Electronic Engng, Vol. 32, 624-9 (Oct., 1960).

A new method of stabilizing the d.c. operating point of transis-

tors, using the silicon resistor, is introduced and its application to both small-signal and power transistors is expounded. Practical evidence is given to show that it is possible, with this method, to obtain constant collector current over the whole operating temperature range of transistors in the great majority of cases.

621.382.3

7927 HEAT SINKS FOR POWER TRANSISTORS. A.F.Lohman.
Electronic Industr., Vol. 19, No. 5, 83-6 (May, 1960).

A general survey of the design of heat sinks for semiconductor devices. Radiative, and natural and forced convective losses are considered, and tables of emissivities, form factors, and thermal conductivities given. British units are used. W.D.Gilmour

621.382.3

7928 CALCULATION OF TRANSISTOR HEAT SINKS. S.I.Federov.
Elektrichestvo, 1960, No. 5, 73-6 (May). In Russian.

A concise treatment of the thermal conditions and balance in the operation of power transistors is given, explaining the above in terms of thermal resistances of the transistor and the radiator, and of the transistor-radiator and radiator-surrounding ambient thermal gradients. Measurement of I_{CO} by means of a simple experimental set-up is briefly described. A detailed treatment is given of heat sink design problems, relation between specific thermal resistance and constants like specific heat losses through radiation and convection body blackness, thermal conductivity, size and thickness of heat sinks, area of contact with transistor shell etc. Numerous curves are reproduced. A.Landman

621.382.3 : 621.374.32

HIGd-CURRENT SOLID-STATE SWITCHES. See Abstr. 7804

621.382.3 : 621.373.431.1

NEGATIVE RESISTANCE OF STORAGE ELEMENTS BASED ON JUNCTION TRANSISTORS. See Abstr. 7716

621.382.333

7929 TRANSISTOR HEAT SINK CALCULATIONS. M.Greenbaum.
Electronics, Vol. 33, No. 32, 66-8 (Aug. 5, 1960).

A method is described using an electrical equivalent circuit of the transistor heat-transfer path. This is then extended to cover the case when several transistors are to be mounted on one heat sink. The factors determining transistor, contact and heat-sink thermal resistance are discussed briefly. Finally a worked example is given. M.Goldberg

621.382.333

7930 TRANSIENT PROCESSES IN A TRANSISTOR IN COMMON EMITTER CIRCUITS. A.Yu.Gordonov.
Fiz. tverdogo Tela, Sbornik [Supplement] II, 319-25 (1959). In Russian.

Reports an experimental investigation of junction transitors in common-emitter circuits under transient and periodic conditions with a small applied signal and with a current generator at the input. Transient, frequency and phase characteristics were obtained. Approximate engineering design formulae for junction transistors are given and discussed. A.Tybulewicz

621.382.333

7931 TRANSISTOR SCALING THEORY. W.E.Roach.
I.R.E. WESCON Convention Record, Vol. 4, Pt 3, 65-71 (1960).

Basic principles are given for the application of scaling theory to the problem of increasing the power capability of a certain class of high-frequency transistors. Effects of the scaling process on transistor characteristics and performance are predicted on a theoretical basic. Measured values for a range of sizes over a 2500 to 1 maximum collector-current range are compared with the theoretical values.

621.382.333

7932 SWITCHING TIMES FOR ALLOY JUNCTION TRANSISTORS. DERIVED FROM THE LARGE SIGNAL EQUIVALENT CIRCUIT. P.James and A.F.Newell.
Mullard tech. Commun., Vol. 5, 159-71 (June, 1960).

An equivalent circuit of the transistor for large signal operation is developed from a simple physical model. The circuit is used to calculate switching times in a few simple examples and methods of measuring parameters of the equivalent circuit are described.

621.382.333

7933 THERMAL RESPONSE OF TRANSISTORS IN THE AVALANCHE MODE.
R.H.Beeson, I.Haas and V.H.Grinich.
Proc. Nat. Electronics Conf., Vol. 15, 546-56 (1959).

Under avalanche conditions the thermal resistance of a transistor is expected to be greater than that obtained in normal operation because of the decrease in area of the current path across the collector–base junction. The high power density in this small area causes an increase in thermal resistance that can be approximately calculated. Experimental verification is obtained for silicon mesa transistors by using the forward-biased base–emitter voltage under avalanche conditions as a thermometer, when a small resistor is connected from base to emitter. It is shown that the thermal resistance of the wafer increases several fold, although the total increase in thermal resistance of the transistor is not as great, and also that the initial thermal time-constant of the wafer decreases several times, though its effect on total thermal response is small. It is concluded that transistors used in the avalanche mode must be derated from their normal use ratings, especially under pulse conditions.

621.382.333

7934 THE INFLUENCE OF NONLINEAR JUNCTION CAPACITANCE ON TRANSISTOR RISE AND FALL TIMES. R.P.Nanavati.
Proc. Nat. Electronics Conf., Vol. 15, 557-65 (1959).

Presents a general theory which predicts the rise time in large signal switching of junction transistors under circumstances where the nonlinear collector junction capacitance cannot be neglected. Fall times may also be approximately predicted by a slight modification of the theory. An attempt is made to solve an equivalent linear problem in which a constant value of collector capacitance is used to obtain the same rise and fall times as in the nonlinear problem. Experimental results with alloy and grown junction transistors as special cases indicate fairly good agreement with the theory.

621.382.333

7935 A NOTE ON THE LIMITS OF APPLICABILITY OF THE SMALL SIGNAL THEORY FOR TRANSISTORS. M.A.Abdyukhanov.
Radiotekhnika i Elektronika, Vol. 4, No. 7, 1094-102 (July, 1959). In Russian.

Analyses the criteria obtained by Rittner [Abstr. 7426 A of 1954; Phys. Rev., Vol. 94, No. 5, 1161-71 (June 1, 1954)] for the applicability of Shockley's transistor theory [Bell Syst. tech. J., Vol. 28, 435 (1949)]. A new exposition and solution of the problem are given for the stationary case and for the case of a low-frequency signal. Shockley's condition $P/D_d \ll 1$ is shown to be sufficient as well as necessary for the theory's validity. D.E.Brown

621.382.333

7936 STRUCTURE AND PRODUCTION TECHNIQUES FOR TRANSISTORS WITH NON-UNIFORMLY DOPED BASE LAYERS. W.Wunderlin.
Scientia Electrica, Vol. 6, No. 2, 80-91 (June, 1960). In German.

A useful descriptive review, with dimensioned diagrams, for the drift, micro-alloy-diffused, single-diffused and double-diffused mesa, and the alloy-diffused structures. F.F.Roberts

621.382.333

7937 THE DEPENDENCE OF CURRENT GAIN ON EMITTER CURRENT IN A DRIFT TRANSISTOR. G.Schwabe.
Z. angew. Phys., Vol. 12, No. 7, 314-20 (July, 1960). In German.

Based on Webster's classical investigations of the above relationship in diffusion transistors with homogeneous base doping, which explained the reduction of α' with I_E by efficiency loss due to growing minority- and majority-carrier concentrations and to reduction of surface recombination in the vicinity of the emitter. A similar analysis is undertaken for transistors with a built-in drift field due to graded doping. Starting with Webster's equation expressing α' in terms of recombination currents (surface and depth) and electron and hole components of emitter current, a concise determination of the surface- and volume-recombination processes,

the emitter efficiency coefficient and the charge carriers in the base region in terms of diffusion-constants and lengths of holes and electrons, mobilities, emitter current density, base width and carrier density y_o is presented. It is shown that whilst for high emitter currents diffusion and drift transistors possess the same falling α' characteristic, they behave differently for small and medium current-densities, as described by the function $g(y_o)$, which mainly depends on the surface recombination and emitter efficiency. This function decreases with growing I_E in the case of diffusion transistors, but increases in drift transistors, due to charge carrier injection altering the field gradient in the base region. The effect on frequency response due to graded doping is shown to disappear when both $g(y_o)$ become identical. The drop in α', which follows $(1 + y_o)$ is less steep for drift transistors due to y_o assuming lower values for identical currents because of the drift field.

A.Landman

621.382.333 : 621.317.61

A SURVEY OF TRANSISTOR MEASUREMENT TECHNIQUES
See Abstr. 7485

PHOTOELECTRIC DEVICES

621.383

7938 CLASSIFICATION AND ANALYSIS OF IMAGE-FORMING SYSTEMS. W.K.Weihe.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1593-1604 (Sept., 1959).

A discussion of devices which produce a visible two-dimensional image of a scene under conditions where there is insufficient illumination for normal viewing. These devices use reflected light originating from, for example, stars, or the infrared radiation emitted from the objects in the scene. The systems considered either form an image of the whole scene on a screen or scan the elements in the scene sequentially. Several examples of each type of system are described, and their performance calculated. Comparison is made with experimental results. C.Hilsum

621.383

7939 PHOTOEMISSIVE IMAGE-FORMING SYSTEMS. R.S.Wiseman and M.W.Klein.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1604-6 (Sept., 1959).

A short description of the infrared image convertor tube, including details of the photoemissive surface, the phosphor screen and the overall performance of modern tubes. C.Hilsum

621.383

7940 INFRARED COLOR TRANSLATION. M.B.Grier.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1574-6 (Sept., 1959).

Radiation from an object is measured simultaneously in several spectral bands, and presented on a screen in colour, one colour corresponding to each infrared spectral band. The theory of the method is given, and some of the applications are described. C.Hilsum

621.383 : 621.317.39 : 535.8 : 536.3

ELECTRICAL AND OPTICAL TECHNIQUES IN THE OPERATION OF INFRA-RED DETECTORS. See Abstr. 7459

621.383.23 : 621.374.32

7941 AN ELECTRON-MULTIPLIER AS A LIGHT-PULSE GENERATOR. R.Gerharz.
Z. angew. Math. Phys., Vol. 7, No. 6, 529-36 (Nov. 25, 1956). In German.

A 7-stage electron multiplier with grid control system is described with respect to construction and performance. A coaxial feedback cable permits the regeneration of pulses with a repetition frequency of from 10 to 0.1 Mc/s and a pulse length of about 8×10^{-9} s. The luminescence of the dynodes was investigated and an identity in the duration of the light pulses and the electrical pulses has been found. The interpretation of the luminescence effects by assuming electro-fluorescence phenomena indicates applications to problems of stroboscopy and of high-speed computation and storage devices.

621.383

7942 AN INFRARED PICKUP TUBE. G.A.Morton and S.V.Forgue.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1607-9 (Sept., 1959).

This tube is an electron beam scanning device in which the video current is a function of the resistivity of the target material. The target is a photoconductive layer of lead sulphide, and it is sensitive to infrared radiation at wavelengths less than two microns. A camera chain using such tubes can form a recognisable image of objects which are hotter than 150° C, using the emitted infrared radiation. C.Hilsum

621.383.27 : 621.387.464 : 539.1.07

7943 THE SCINTILLATION COUNTER. G.A.Morton.
Nuclear Electronics Conference, Paris, 1958. Vol. I. (see Abstr. 4975 of 1960) p. 3-13.

The characteristics of various scintillator materials and of a number of photomultipliers are compared. The loss of energy discrimination due to the scintillator and photomultiplier efficiency and instability, as well as the statistical time errors in both components, are discussed. In the scintillator, time errors arise because the emission of photons is a random process; in the photomultiplier, the time distribution is due mainly to differences in the path lengths of electrons. Developments aimed at improvement of the multiplier are discussed and some circuits for measurement of very short time intervals are described. W.G.Stripp

621.383.27 : 621.317.39 : 537.533

7944 A FAST PHOTOMULTIPLIER AND COINCIDENCE SYSTEM FOR PRECISE TIME MEASUREMENTS. G.A.Morton and R.M.Matheson.
Nuclear Electronics Conference, Paris, 1958. Vol. I (see Abstr. 4975 of 1960), p. 201-8.

In a new R.C.A. photomultiplier, electron path lengths between dynodes are made as nearly equal as possible and in each inter-dynode space the electrons are accelerated by electrodes at potentials around 3 kV, so that small differences of path length are made unimportant because of the high average velocity. A shield around the collector reduces the displacement-current effect, and a curved photocathode, in conjunction with relatively high potentials on the lens elements, minimizes the effect of initial velocities. To test the photomultiplier, a beam-deflection tube was used. Pulses were obtained from the anodes and the last dynodes of two photomultipliers and applied to the deflector plates. The rest position of the beam is on a 45° radius of a screen, at the centre of which is a small aperture. Pulses which are coincident after suitable amplitude adjustment and delay, deflect the beam so that it crosses the aperture and is detected by a photomultiplier behind the screen. Non-coincident pulses deflect the beam on a curved path which does not cross the aperture. The time distribution curve of the beam deflection coincidence tube has a half-amplitude width of 2.5×10^{-10} sec. W.G.Stripp

621.383.27

7945 A GRID-CONTROLLED ELECTRON MULTIPLIER TUBE. D.C.Brown and M.F.Penny.
J. Electronics and Control, Vol. 8, No. 6, 431-9 (June, 1960).

The properties of an experimental grid-controlled photomultiplier tube were investigated and, under pulsed operation, a transfer conductance of 60 mA/V was achieved. The primary electron current was produced by placing a suitable scintillator near the photocathode and energizing it by means of a radioactive source of Sr^{90}. This resulted in a substantially constant illumination of the photocathode and, because of the long half-life of the Sr^{90}, high long-term stability for the production of the primary electron current.

621.383.4

7946 PHOTOELECTRIC CONTROL USING COLD CATHODE AMPLIFIERS. P.Bergweger.
Electronics, Vol. 33, No. 27, 46-7 (July 1, 1960).

The merits of photoconductive cells and photoemissive vacuum tubes are discussed and contrasted, and two control circuits using both types of light sensing elements are described. The first circuit consists of a simple automatic light control with photoconductive cell and cold-cathode tube for a.c. operation. The voltage at the starter electrode of the cold-cathode tube is determined by voltage dividing resistors in series with the cell. At dusk the cell resistance increases until the starter breakdown voltage is reached, thereby

switching the tube on. In the anode circuit of the tube is a temperature compensated thermal relay consisting of a bi-metal operated microswitch which prevents the control from reacting to short fluctuations of ambient light. The cold-cathode tube is triggered by the starter electrode during each positive half-cycle until at dawn the illumination increases and reduces the output of the photoconductive cell below the triggering level of the cold-cathode tube. The second circuit employs a high-vacuum photoelectric cell and d.c. cold-cathode tube amplifier to provide a high degree of accuracy and stability. With d.c. operation, a conducting cold-cathode tube can only be switched off by interrupting or lowering its anode voltage. Therefore, for on–off operation, two tubes are used in a multivibrator circuit. H.A.Miller

621.383.4

7947 DESIGNING SOLAR POWER SUPPLIES FOR TRANSISTORIZED RADIO RECEIVERS.

J.Kalman.
I.R.E. Trans Broadcast and Televis. Receivers, Vol. BTR-6, No. 1, 21-4 (May, 1960).

The solar battery described is intended for use in conjunction with a nickel–cadmium battery, charging the latter as required and at other times contributing some of the load current. The cell characteristics are as follows: (1) the voltage parameter is proportional to the logarithm of the illumination level; (2) the output voltage is independent of cell area; (3) voltage falls slightly with increasing temperature; (4) current output is proportional to cell area; (5) short-circuit current is proportional to illumination level; and (6) current is independent of temperature. Under the conditions of use a protective diode must be included between cell and battery although this introduces a 0.4-0.7 V drop. Characteristic curves and dimensions and costs of commercial solar packs are given. H.G.M.Spratt

621.383.4 : 541.18

7948 RAPID COUNTER FOR SMALL PARTICLES IN SUSPENSION. J.B.Cornwall and R.M.Davison.

J. sci. Instrum., Vol. 37, No. 11, 414-17 (Nov., 1960).

Equipment based on a photoelectric detection method is described which has been designed for counting apple cells (approximate size distribution 70-500 μ length) but which may be used with any reasonably opaque particles of suitable size which can be held in suspension in a clear low-viscosity liquid. The accuracy of a single run is about ±3% including sampling errors. This error may be reduced by averaging several samples.

621.383.4

7949 SINTERED CADMIUM SULFIDE PHOTOCONDUCTIVE CELLS. C.P.Hadley and E.Fischer.

Proc. Nat. Electronics Conf., Vol. 15, 253-61 (1959).

Discusses the properties of cells. The information which is presented was gathered during a long programme leading to large-scale commercial production of such cells. Fabrication techniques are discussed, including properties of the host materials, activation impurities, electrodes, and packaging. Theory is presented regarding energy level structure, sensitivity, time effects, geometry, ohmic contacts, and gamma. Finally, characteristics are discussed with respect to the practical application of the cells.

621.383.4

7950 THE SOLAR BATTERY. M.Wolf.

Proc. Nat. Electronics Conf., Vol. 15, 226-40 (1959).

Seven factors limiting the performance of photovoltaic solar energy convertors are listed and explained. They can be classified into basic and technology-determined limitations. Possibilities for improvement on technology-determined limitations are investigated for the silicon solar cell. Conversion efficiencies of 15-17% should become obtainable by application of these techniques. Materials other than silicon are discussed. New methods, such as the multilayer and the multiple transition solar cell, are discussed. Both methods yield theoretically large improvements, but depend on further advances in compound semiconductor technology and on knowledge about localized centres in the forbidden gap. Limit conversion efficiencies of 38.2% for a 3-layer cell and of 51% for a 3-transition cell (compared to 23.6% for a single p–n junction, single transition cell) are obtained. Merits of applying the graded energy gap to photovoltaic energy convertors are discussed and potential improvements in collection efficiency are found for certain cases.

621.383.5 : 621.317.733

7951 CONSTRUCTION AND PERFORMANCE OF A POSITION-SENSITIVE PHOTO-TRANSISTOR. L.R.Baker.

Optica Acta, Vol. 7, No. 2, 191-8 (April, 1960).

A description is given of the construction of a solid-state light detector whose voltage output is related in phase to the position of a light spot on the receiving surface. The mechanical, optical and electrical stability is considered in an attempt to approach the very high degree of ultimate sensitivity expected. Test results describing the performance of the detector from these points of view are included.

PARTICLE ACCELERATORS

621.384.6 : 537.54

7952 REGENERATIVE ACTION IN HIGH ENERGY ACCELERATORS. S.Cohen and A.V.Crewe.

Nuclear Instrum, Vol. 1, No. 1, 31-40 (Jan., 1957).

It is shown that the regenerative method for the extraction of particles from an accelerator can be extended to include machines other than cyclotrons. This is accomplished by the use of radial oscillations in which the regenerative action does not occur on every revolution of the particle about the machine. In particular, that mode of oscillation which allows regenerative action on every other turn is analysed and shown to permit extraction from circular machines whose values of n, where $n = -RH^{-1}(dH/dr)$, lie near 0.75. An extension of the analysis to machines with straight sections and strong focussing machines is included.

621.384.6 : 537.54

7953 A NEW PARTICLE ACCELERATOR. Y.P.Varshni.

Nuclear Instrum., Vol. 1, No. 5, 280-1 (Sept., 1957).

Suggests the construction of spiral dees to overcome difficulties in particle acceleration due to the relativistic increase in mass at high velocities.

621.384.6 : 537.54

7954 PULSED BEAM DEFLECTION SYSTEM FOR A LINEAR ELECTRON ACCELERATOR. M.J.Poole, G.Dean and W.Howe.

Nuclear Instrum., Vol. 2, No. 3, 282-6 (April, 1958).

A method has been developed to permit the simultaneous use of two targets with a pulsed linear electron accelerator. A magnet is arranged to deflect the beam onto one or the other target, and this magnet is electronically switched on or off in the interval between the beam pulses. A "countdown" circuit is used to select which pulses shall be directed to each target.

621.384.6

7955 A POSSIBILITY OF INCREASING THE CURRENT INTENSITY AND ENERGY OF THE MICROTRON. A.Paulin.

Nuclear Instrum. and Methods, Vol. 5, No. 2, 107-10 (Aug., 1959). In German.

The energy gain during the first crossing of the accelerating gap of the microtron resonator, and the transition of the electrons into phase-stable region are investigated. It is shown that for proper operation of the X-band microtron the accelerating gap should not be greater than 3 mm. A modification of the S-band microtron is proposed. Using a magnetic field of 4400 gauss and a peak voltage of 2.3 MV across an accelerating gap of 21 mm it seems possible to obtain a four times greater energy at the same diameter of the magnet than with the microtrons built so far.

621.384.6 : 621.372.829 : 537.54

7956 CONSIDERATIONS ON THE CONSTRUCTION OF A HELICAL LINEAR ACCELERATOR FOR PROTONS. W.Müller and J.Rembser.

Nuclear Instrum. and Methods, Vol. 4, No. 4, 202-12 (May, 1959). In German.

The method of accelerating heavy particles in a helix waveguide as repeatedly suggested in literature has been examined theoretically in detail. The first part of this article deals with the h.f. characteristics of the waveguide that were taken from known investigations based on the Pierce theory. A more accurate examination of the

acceleration process for protons shows that the accelerating electric field strength on the axis of the helix is strongly reduced for proton energies $\gtrsim$ 30 MeV, while for proton energies $\gtrsim$ 0.5 MeV the losses in the waveguide considerably increase. In the case discussed here (acceleration of protons from 1 to 10 MeV) the optimum vacuum wavelength was found to be ~1.5 m. With a h.f. source output of 0.5 MW such an accelerator would have a length of ~12 m, while the diameter of the shield would be 12 cm, the volume being about 0.15 m^3.

621.384.6 : 537.54

7957 A SYNCHRO-CYCLOTRON PULSE SIMULATOR FOR TESTING ELECTRONIC CIRCUITS.

T.Fazzini, G.Fidecaro and H.Paul.
Nuclear Instrum. and Methods, Vol. 5, No. 3, 156-60 (Sept., 1959).

An electronic pulse generator is described that can be used to test electronic circuits under conditions of alternating high and zero counting rate similar to those existing at a synchro-cyclotron. It consists of a gated oscillator and a pulse sharpener.

621.384.6 : 537.54

7958 ELECTRON MODEL OF A SPIRAL SECTOR ACCELERATOR. D.W.Kerst, E.A.Day, H.J.Hausman, R.O.Haxby, L.J.Laslett, F.E.Mills, T.Ohkawa, F.L.Peterson, E.M.Rowe, A.M.Sessler, J.N.Snyder and W.A.Wallenmeyer.
Rev. sci. Instrum., Vol. 31, No. 10, 1076-1106 (Oct., 1960).

A six-sector spiral-ridge fixed-field alternating-gradient accelerator has been constructed and successfully operated to accelerate electrons from 35 to 180 keV kinetic energy. Acceleration was by betatron action, supplemented by radio-frequency acceleration when desired. The design was based on magnetostatic and orbit computations performed with the Illiac digital computer, and the subsequent performance was found to be in good accord with these computations. Tuning coils permitted variation of the basic parameters about the design values suggested by the computations, so that an experimental investigation could be made concerning the importance of nearby resonances. The theoretical basis of the computational work and the specific results obtained are first described, followed by a resumé of the constructional features and magnetostatic measurements. Tests with the operating model are then reported, comprising a resonance survey, injection studies, perturbation studies, and the use of radio-frequency acceleration. The frequencies of radial and axial betatron oscillation at the nominal operating point were respectively, $\nu_x = 1.40$ and $\nu_y = 1.12$, and the resonance survey indicated this operating point to be centrally located within a region of relatively large intensity which was bounded by the resonances $\nu_y = 1.0$, $\nu_x = 1.5$, and (less markedly) $2\nu_y - \nu_x = 1$. Injection from a deflector structure with a thin septum permitted efficient injection to be achieved either by concomitant rapid acceleration of the injected electrons or, alternatively, by use of a time dependent radial electric field applied as a perturbation. Experiment with a protracted injection pulse permitted the observation of phenomena attributable to space charge effects. A suitable frequency modulation schedule permitted successful acceleration of a substantial fraction of stacked electrons through the transition energy. Appendices describe a modulator, with negative feedback stabilization, to permit protracted injection, a magnetometer, used in the magnetic field measurements, and the essentials of Parzen's theory of perturbations, which was found to account satisfactorily for the results of the perturbation experiments.

621.384.611 : 537.54

7959 THE PRETORIA CYCLOTRON.
J.J.Burgerjon, S.J.du Toit and C.A.J.Kritzinger.
Nuclear Instrum., Vol. 3, No. 6, 323-35 (Dec., 1958).

A brief technical description of the Pretoria fixed-frequency cyclotron is given. It is a 112 cm machine which at present accelerates internal deuteron beams of 200 microamperes to 15 MeV. Interesting features are a double ion source and automatic target removal and despatch mechanism.

621.384.611 : 537.54

7960 THE FOCUSING AND ANALYSING MAGNETS OF THE SACLAY CYCLOTRON. J.Thirion and J.Saudinos.
Nuclear Instrum. and Methods, Vol. 5, No. 3, 165-9 (Sept., 1959). In French.

Two strong gradient magnets deflect and refocus the beam of the cyclotron in both directions. The beam is then analysed by a double focusing magnet which gives a definition in energy of 1.5/1000 for 2 mm slits. This analyser can also be used for analysing secondary particles.

621.384.611 : 537.54

7961 EFFICIENT BEAM EXTRACTION FROM A SYNCHRO-CYCLOTRON AT n = 1.

S.Suwa, J.Sanada, T.Karasawa, A.Suzuki, H.Ogawa, H.Yamaguchi, Y.Saji, S.Kikuchi, H.Kumagai, I.Hayashi, K.Matsuda and K.Nisimura.
Nuclear Instrum. and Methods, Vol. 5, No. 3, 189-93 (Sept., 1959).

With an electrostatic deflector placed at n = 1 (the point of maximum Br), about 50% of the internal beam (inside n = 0.2) of the 160 cm synchro-cyclotron could be extracted, and most of the extracted beam was confined within a 2.5 cm diameter area at the tank exit by inserting a magnetic channel acting as a focusing lens. The homogeneity of the magnetic field is essential for this method of beam extraction. The configuration and position of the ion source, and the dee bias voltage were found to affect the transmission of the beam through n = 0.2 to n = 1. Under the optimum conditions, 70-80% of the beam inside n = 0.2 reached n = 1.

621.384.612 : 537.54

7962 FOCUSSING OF THE SYNCHROTON SCATTERED-OUT BEAM. H.B.Van Der Raay.
Nuclear Instrum., Vol. 1, No. 6, 351-3 (Dec., 1957).

A means of focusing the scattered-out beam of the Birmingham Proton Synchrotron by modifying the magnetic fringing field is outlined. The beam is brought to a spot focus of about 20 cm^2 a distance of 5 metres from the exit port and has a mean intensity of 5×10^3 particles/cm^2 per pulse.

621.384.612 : 621.317.7 : 537.54 : 539.1.07

CERN MEETING ON NUCLEONIC INSTRUMENTATION FOR HIGH ENERGY PHYSICS. See Abstr. 7489

621.384.612 : 621.317.43 : 538

MEASUREMENT OF MAGNETIC FIELD IN SYNCHROTRON GAP. See Abstr. 7472

621.384.612 : 621.318.3 : 538.1 : 537.54

THE TESTING OF THE ELECTRO-MAGNET SEGMENTS OF THE SACLAY SYNCHROTRON. See Abstr. 7545

621.384.62

7963 OPTICAL PROPERTIES OF A HELICAL MAGNETIC QUADRUPOLE [LENS]. G.Sacerdoti.
Elettrotecnica, Vol. 47, No. 5, 321-8 (May 10, 1960). In Italian.

Describes a device for focusing beams of charged particles. The lens consists of a four-pole magnetic yoke, carrying energizing coils, whose pole faces are curved helically around the axis of the lens. The theory of the device is given, together with a sketch of the suggested construction. V.G.Welsby

ELECTRON TUBES

621.385.032.213

7964 EXPERIMENTS WITH CATHODES OF HIGH CURRENT DENSITY. M.Bartela, W.Szczerski and A.Taczanowski.
Przeglad Electron., Vol. 1, No. 1, 12-16 (1960). In Polish.

The following types are described: (1) pressed cathode (nickel powder with Ba, Sr and Ca carbonates using tungsten or zirconium hydride as activator), up to 2 A/cm^2, long activation, high stability, disks or cylinders; (2) an impregnated cathode (sintered nickel powder base) 0.5 to 1.5 A/cm^2; (3) a sintered cathode (coarse nickel powder with binder and added tungsten sintered into cathode shape, carbonates pasted on under vacuum), up to 20 A/cm^2, fast activation, high field-stresses permissible. A.Sczaniecki

621.385.032.213.13

7965 MIGRATION OF THE ACTIVATORS, MAGNESIUM AND SILICON, IN INDIRECTLY HEATED OXIDE CATHODES. W.Dilsing.
Telefunken-Röhre, No. 36, 99-110 (Oct., 1959). In German.

During operation silicon migrates mainly into the interface

layer between sleeve and (BaSr)O. On the other hand, Mg migrates both into the interface and the bulk coating and even into the vacuum. In the interface the Si concentration is 100-500 times and the Mg concentration 100 times the concentrations in the bulk of the coating. A.H.W.Beck

621.385.032.213.13

7966 THE EVALUATION OF THE OXIDE PROPORTION OF SILICON AND MAGNESIUM IN CATHODE NICKEL AS A MEASURE OF THE TRUE ACTIVATOR CONTENT. H.Leibiger.
Telefunken-Röhre, No. 36, 111-34 (Oct., 1959). In German.

Only the metallic forms of Si and Mg are useful as activating agents but roughly 50% of the total Si, Mn content of typical cathode alloys is in the form of oxide. Chemical methods for measuring the amount of oxide are discussed and analyses for typical cathode nickels are given. The MgO content increases markedly during the drawing process. A.H.W.Beck

621.385.032.213.13

7967 REMARKS ON THE PROBLEM OF ELECTRIC BREAKDOWNS BETWEEN HEATER WIRE AND CATHODE SLEEVE OF INDIRECTLY HEATED CATHODES.
K.Veith and H.Kallweit.
Telefunken-Röhre, No. 36, 135-58 (Oct., 1959). In German.

An experimental account of model tests which show that breakdown is caused by oxidation of residual tungsten oxide films. However, these findings are not in accordance with the usual findings on valves which lead to the hypothesis that ionic conduction of W ions through the Al_2O_3 is responsible. A.H.W.Beck

621.385.032.213.13

7968 TEMPERATURE VARIATIONS OF AN OXIDE-COATED CATHODE PRODUCED BY CURRENT FLOW.
G.Mesnard and R.Uzan.
Vide, Vol. 15, 301-12 (July-Aug., 1960). In French and English.

Many experimental results are given on the variation with time of the temperatures of filament, cathode core, cathode coating and anode, from the moment current is drawn in a triode, and also from the moment it is cut off. Typically, for example, both the core and coating of a moderately aged cathode first cool a fraction of 1°C in about ½ minute and then warm to a steady overheated state in about a minute; whereas in a well aged cathode the core warms up only a little and then overcools again. The role of pores in the core and gases in them is discussed with a view to explaining some of the results. B.Meltzer

621.385.032.213.63

7969 METHOD OF COATING OXIDE CATHODES IN THE CENTRIFUGE. H.Huber and J.P.Freytag.
Vide, Vol. 15, 234-50 (May-June, 1960). In French and English.

A method for coating oxide cathodes in the ultra-centrifuge is described in full detail. The resulting coating is smooth and dense and the thickness can be controlled from 5-50 μ. A.H.W.Beck

621.385.1

7970 ON THE PROPERTIES AND APPLICATIONS OF VACUUM-TIGHT CERAMIC IN VACUUM [AND THERMIONIC-TUBE] TECHNOLOGY. R.Harman.
Slaboproudy Obzor, Vol. 21, No. 9, 535-42 (1960). In Slovak.

The composition, electrical characteristics and physical properties of the following low-loss ceramics are discussed: steatites, forsterites, corundums, porcelains and ceramics with a high content of Al_2O_3. The data are given in six tables and two graphs. Several methods of producing ceramic-to-metal seals are briefly described. Properties of the ceramics are critically surveyed, and it is concluded that these materials can justifiably be employed in: high-quality transmitting valves, reliable electronic valves for military purposes, subminiature valves with special electrode construction, special vacuum instruments, mercury rectifiers, valves for rocket equipment and nucleonic instrumentation. R.S.Sidorowicz

621.385.1 : 621.382.3

7971 TUBES OR TRANSISTORS: A REALISTIC ASSESSMENT. R.E.Moe.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 81-5 (1960) = Commun. and Electronics, No. 48 (May, 1960).

A survey of the valve versus transistor controversy, biased in favour of valves. The known disadvantages of transistors at high temperatures (>200°C) at high voltages (>80 V), for use at v.l.f. (<10 c/s), for high power working at high frequencies (>10 W, 3 Mc/s), and under γ-ray and neutron bombardment are stressed and attention is drawn to the spread of transistor characteristics and to the lack of information on their reliability. The small volume occupied by a bare transistor is often off-set by the need for a heat sink, and single valves often have to be replaced by more than one transistor. 15 references. W.D.Gilmour

621.385.1 : 621.382

7972 SHALL AN ELECTRON TUBE OR SEMICONDUCTOR DEVICE BE USED? E.E.Scheneman and S.K.Waldorf.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 264-8 (1960) = Commun. and Electronics, No. 49 (July, 1960).

A summary is presented of numerical data in order of magnitude to serve as a general guide in cases where either device is considered applicable. Three tables show (a) satisfactory environmental conditions for both devices; (b) satisfactory electrical operating conditions for hot-cathode tubes and transistors; (c) satisfactory electrical operating conditions for tubes and semiconductors used as switches, regulators or rectifiers. Examples of choice of equipment are given in such cases as consumer products and industrial and military applications. Illustrations are given of comparative sizes of units performing similar functions and also comparative weights and power consumption of electron tubes and semiconductors. Two references to the effects of nuclear radiation are given. B.B.Austin

621.385.1

7973 TECHNOLOGICAL IMPROVEMENTS IN HIGH-TEMPERATURE THERMIONIC TUBES. M.Gallet.
Vide, Vol. 15, 251-62 (May-June, 1960). In French and English.

Techniques are described which make possible the production of electron tubes to operate in ambient temperatures of up to 500°C. The thermal, electrical, mechanical and chemical requirements of the materials for such tubes are discussed. The final design incorporates a 99% pure alumina ceramic sealed to a nickel–iron–cobalt alloy, with the heat-dissipating components of the tube of pure copper. The reasons for this choice of materials are given together with a description of some of the tests performed. An electrolytic process has been developed which provides a surface protection for the metal parts of the tube. The coating is non-corrodible at 500°C in atmospheric conditions, has high electrical conductivity and can be applied to sealing alloys, brazing alloys and to pure copper. It is suggested that the techniques developed could be applied with advantage to a wide variety of electron tubes. B.Dunford

621.385.1

7974 DETECTION AND IDENTIFICATION OF DISTILLATES IN TUBES. M.Gobin.
Vide, Vol. 15, 263-7 (May-June, 1960). In French and English.

In order to identify deposits and stains which occur on the components of electron tubes the parts are removed using non-contaminating tools. They are individually wrapped in a suitable filter paper impregnated with an appropriate reagent and this package is then sharply compressed between mica sheets. The paper in contact with the part being investigated shows a print of the deposit on the component which can then be interpreted by normal chromatographic methods. Examples are given of the identification of barium, strontium and nickel deposits on tube micas. Internal bulb deposits can be identified by slightly modifying the procedure. Theoretically all elements giving a characteristic coloured drop reaction can be detected down to the sensitivity limit of the reaction. B.Dunford

621.385.1

7975 NEW APPLICATIONS OF GLASS IN ELECTRONICS. J.Herbert.
Vide, Vol. 15, 268-85 (May-June, 1960). In French and English.

The properties of some modern glasses to meet the new requirements of electronics are discussed. Surface chemical instability leading to variations of insulation properties can be limited by reducing the quantity of alkaline elements in the glass thereby reducing surface hydrolysis. Halogen-free glasses considerably reduce the risk of the evolution of cathode-poisoning gases during electron tube processing. The use of alumino-silicate glasses with a high softening temperature enables higher tube processing temperatures to be used. The elimination of sodium ions during manufacture results in greatly improved dielectric properties of some glasses. Glass components, accurately dimensional with close tolerances can be produced by sintering glass powder in a mould or by pressing

a mixture of glass powder and binder to shape prior to sintering. Chemical machining of photo-sensitive glass further increases the accuracy and possible complexity of insulating components. The properties of a number of French and American commercial glasses are tabulated. B.Dunford

621.385.1

7976 SOME USES OF RADIOACTIVE ELEMENTS IN VACUUM TUBES. M.C.Berthaud.

Vide, Vol. 15, No. 88, 324-9 (July-Aug., 1960). In French.

Examples of the uses discussed include: (1) determination of sodium content of alumina heater coatings; (2) tracer elements used to measure efficiency of degreasing procedures; (3) study of migration phenomena. A.H.W.Beck

621.385.1

7977 CERAMIC–TITANIUM SEALING PROCESS. A.J.Velte.

Vide, Vol. 15, 330-41 (July-Aug., 1960). In French and English.

High purity alumina ceramics can be brazed direct to titanium metal with silver–copper eutectic alloy, without prior metallizing. A modification of the method for brazing titanium to Forsterite ceramics is used. All seals must be designed so that the ceramic is in compression throughout the temperature range used and the stresses induced in the metal should not exceed the elastic limit of the titanium. The temperature at which the seal is made must be accurately controlled to develop the maximum ductility of the brazed joint. Cylindrical components of up to 90 mm diameter have been brazed as well as sapphire window disks of 50 mm diameter. An appendix gives the method of calculating the stresses in the seal. B.Dunford

621.385.1

7978 SOME VACUUM PROBLEMS IN THE VALVE INDUSTRY. N.W.Robinson.

Vacuum, Vol. 6, 21-40 (Oct., 1956: publ. April, 1959).

The end of life in a valve is regarded as being due to deterioration of the cathode through the poisoning action of some residual gases. This paper deals with some problems encountered in the valve industry in reducing the residual gases to a minimum. Simple considerations show that the gas on the surfaces of the assembly and the glass envelope may be many times that in the space. The surface gases may by due to gas adsorbed from the atmosphere or to contamination during manufacture. Meticulous control of the material used in the valve by chemical analysis before fabrication helps to reduce one form of contamination and clean rooms and filtered air conditioning help in reducing contamination during the assembly. The valve engineer attempts to eliminate gases by suitable heat treatment and processing during pumping. The mass spectrometer is proving a useful tool in detecting contaminants in residual gases. New trends in vacuum technology show that all-metal pump systems with metal taps are tending to replace glass systems and greased taps when single valves are pumped. The improved form pf ionisation gauge, which can be used as a pump as well as a measuring device is being used to continue pumping after removal of the main tube from the normal pumping system. The ionization gauge can also be used as a sensing device for control of automatic pumping systems. Cathodes are still the subject of intensive development and while special cathodes have been introduced for particular valves, the oxide cathode remains supreme in receiver valves. New methods of control have resulted in denser and more uniform cathode coatings on mass production tubes. In research, the ability to reach pressures of less than 10^{-10} mm Hg has resulted in the detection of gases desorbed from various metals at relatively low temperatures. Some of the gases have a poisoning effect on oxide cathodes.

621.385.1

7979 THE GETTERING PROCESS IN MODERN RECEIVING VALVE MANUFACTURE. P. della Porta.

Vacuum, Vol. 6, 41-58 (Oct., 1956: publ. April, 1959).

Gettering technique and getter performance as far as it comes within the sphere of the valve processing engineer is discussed. A brief review of getter design development is given. This is followed by a critical discussion of the "ideal" requirements of the valve manufacturer compared with the actual processing properties of the various modern getters such as the stirrup getter, the coated and the sintered ring getter. Brief reference is made to the testing of getters and to the absorption characteristics of ring getter deposits.

621.385.1.032.24

7980 USE OF FRAME GRIDS IN RECEIVER VALVES. P.Sainte-Beuve.

Vide, Vol. 15, 220-5 (May-June, 1960). In French.

Describes the development of frame grids for valves type EF 184 and EL 183. These valves, made necessary by the requirements of 819-line television apparatus, have high g/c ratios but are cheap enough for mass-production apparatus. A.H.W.Beck

621.385.2

7981 THEORY OF A SPACE CHARGE LIMITED DIODE. H.Pötzl and K.Richter.

Arch. elekt. Übertragung, Vol. 14, No. 5, 225-34 (May, 1960). In German.

A simplified theory of electron flow is derived starting from fundamental hydrodynamical equations, i.e. motion equations of particle density, momentum and energy. A constant kinetic temperature of electrons (isothermal flow) is assumed and it is shown how the equations of a space charge limited diode can be solved analytically, without further approximation, for both the stationary and non-stationary cases. Boundary conditions for the current–voltage relationship are found by analysing the space charge density in the cathode plane. The results obtained in the stationary case agree with Langmuir's theory, and calculated values of diode admittance agree fairly well with experimental data. J.M.Silberstein

621.385.2 : 537.533

7982 EFFECT OF MAGNETIC FIELDS ON THERMIONIC POWER GENERATORS. A.Schock.

J. appl. Phys., Vol. 31, No. 11, 1978-87 (Nov., 1960).

It is demonstrated that the high currents present in large thermionic power generators produce magnetic fields which result in a considerable reduction of electron transmission and energy conversion efficiency. To overcome the adverse effect of the self-induced field, the report presents the concept of a magnetothermionic power generator, employing an externally produced magnetic field parallel to the current direction. Analysis indicates that this concept will permit efficient operation of large generators. In addition, by use of a modulated field coil current, it offers the possibility of the direct generation of alternating current, at a controlled frequency.

621.385.2 : 537.533

7983 POTENTIAL DISTRIBUTION BETWEEN TWO PLANE EMITTING ELECTRODES. II. THERMIONIC ENGINES. P.A Lindsay and F.W.Parker.

J. Electronics and Control, Vol. 9, No. 2, 81-111 (Aug., 1960).

Gives expressions for the potential distribution between two plane parallel emitting electrodes, extending the work of a previous paper (Lindsay and Parker 1959). It is shown that all potential distributions can be represented by a two-parameter family of curves, the parameters being the ratio of the electrode temperatures $\theta = T/T$ and a constant A which depends on θ and on the potentials and work functions of the two electrodes (A reduces to the parameter of Lindsay and Parker [Abstr. 7152A of 1960; J.Electronics and Control, Vol. 7, No. 4, 289-315 (Oct., 1960)] for $\theta = 1$). The results show rather clearly the relative influence of all these quantities on the position and depth of the potential minimum between the electrodes.

621.385.2 : 537.533

7984 TRANSIENT SPACE-CHARGE FLOW. R.J.Lomax.

J. Electronics and Control, Vol. 9, No. 2, 127-46 (Aug., 1960).

The results of a numerical investigation of the flow of space-charge under non-steady-state conditions in a parallel plane diode are described. These show how the steady state is set up from an initial state, or in the case where a virtual cathode is formed, how a quasi-steady state is established. Under retarding field conditions, oscillations are observed which are thought to be related to Barkhausen–Kurz oscillations.

621.385.2 : 681.142

7985 DETERMINATION OF PLANE, CIRCULAR AND SPHERICAL-SYMMETRICAL SPACE-CHARGE FIELDS USING A SIMPLE RESISTANCE CHAIN WITH ADDITIONAL CURRENT SOURCES. G.Cremošnik and M.J.O.Strutt.

Z. angew. Math. Phys., Vol. 8, No. 5, 329-60 (Sept. 25, 1957). In German.

Resistance chains, used as analogous computers, allow the

determination of static potentials without and with space charge of high-vacuum diodes, the fields of which may be considered as one-dimensional. In the case with space charge, additional currents, fed into the resistance chain, are essential for the representation of the space charge. Such resistance chains with additional current sources afford solutions of Poisson's equation

$$\frac{\partial^2 V}{\partial r^2} + \frac{\nu}{r} \cdot \frac{\partial V}{\partial r} = \frac{\rho}{\epsilon}$$

The first problem under consideration is the plane diode, for which $\nu = 0$. Here the solution of Poisson's equation is obtained by iteration: (a) with zero emission velocity at the cathode; (b) with finite emission velocity; (c) with Maxwellian emission velocity distribution at the cathode. The solutions take much less time using the resistance chain than using the well-known formulae for these problems. The second problem concerns the circular cylindrical diode ($\nu = 1$) with zero and with finite emission velocity at the cathode. In the latter case, no straight-forward mathematical solution is known. Again, practical solutions are easily obtained by iteration using the resistance chain. Finally, a spherical diode ($\nu = 2$) is considered at zero emission velocity. Here also, the chain affords easy solutions. The computed chain-solutions were compared with known formulae in several cases, showing discrepancies not over 1% in most cases.

621.385.33.029.6

7986 NON-LINEAR DISTORTIONS DUE TO ELECTRON TRANSIT TIME IN TRIODES. H.Leysieffer.

Arch. elekt. Übertragung, Vol. 14, No. 6, 269-82 (June, 1960). In German.

Amplitude distortion of an amplifier valve depends on the transit angle, i.e. on the mechanical lay-out and working parameters of the valve. The exact relationship between the transit angle and the transit-time-dependent distortion is of great importance in the design of systems using single sideband modulation. Only cubic distortion caused by a triode falls into the useful band. The analysis is based on the theory of linear transit-time phenomena but takes into account periodical time dependence of the transit angle, important even in small-signal conditions. Distortion in the cathode–grid and grid–anode space is calculated and the overall distortion is discussed. Analytical results are compared with data measured in the lower u.h.f. region and good agreement is found as regards distortion in the grid–anode space, but agreement is less satisfactory for the cathode–grid space. J.M.Silberstein

621.385.5

7987 UTILIZATION OF SOME ELECTRONIC TUBES IN ELECTROMETER CIRCUITS. C.Onu.

Bul. Inst. Politeh. Iasi, (Ser. nouă), Vol. 5(9), No. 1-2, 261-4 (1959). In Roumanian.

Results of measurements taken on miniature, battery-heated types 1S5, 1T4, 1U5 and 1R5 are given. Grid currents are measured by the method of charging the input capacitance and then observing the discharge due to grid current flow. Conclusions show that grid currents are small in comparison with some special electrometer tubes, static slopes are small i.e. of the order of a few μA/V and that the static amplification factor, when the tubes are used as triodes, is of unity order whereas this factor may be of high order, up to hundreds, when they are as pentodes. Two circuits are given for the measurement of α-particle pulses in an ionization chamber, showing the input stage either triode- or pentode-connected. 3 references. A.Reiss

621.385.6

7988 THE ROLE OF SPACE CHARGE WAVES IN MODERN MICROWAVE DEVICES. I-III.

G.D.Sims and I.M.Stephenson.

Electronic Engng, Vol. 32, 408-12 (July); 499-503 (Aug); 567-71 (Sept., 1960).

An introduction to the properties of space-charge waves and the way in which they play a part in the operation of certain modern electronic devices. Pt I deals with the fundamental characteristics of space-charge wave propagation and shows how the waves can be considered in terms of a transmission-line analogy. Pt 2 discusses how the space-charge waves are modified by different launching conditions and different beam symmetries, while Pt 3 indicates the part played by simple space-charge waves, ion waves and cyclotron waves in backward-wave oscillators, travelling-wave tubes, parametric amplifiers and simple plasmas.

621.385.6

7989 SYSTEMATICS AND TECHNICAL STATE OF MICROWAVE TUBES. L.Brück and W.Klein.

Frequenz, Vol. 14, No. 6, 198-210 (June, 1960). In German.

A review, in which microwave valves are described according to their functional class and some examples of the various performances achieved are given. A.H.W.Beck

621.385.6 : 537.56

7990 RADIO-FREQUENCY FORCED OSCILLATIONS IN NON-UNIFORM PLASMAS. R.B.R.-Shersby-Harvie.

J. Electronics and Control, Vol. 8, No. 6, 421-30 (June, 1960).

A wave equation and associated equations is derived for periodic forced oscillations in a collision free plasma. This set of equations is rather complicated and small signal approximations are derived, which are applicable to plasma confinement problems. One approximation is applied to the case of a fast E_0 travelling wave in plasma and its behaviour is shown to be markedly different from the well-known case of an E_0-wave at cut-off. Some difficulties with small signal theories are indicated and the need for further clarification pointed out.

621.385.623.5

7991 REFLEX KLYSTRON AMPLIFIERS WITH HYBRID T COUPLING. K.Ishii.

Electronics, Vol. 33, No. 24, 64-5 (June 10, 1960).

Input and output couplings to a one-port regenerative reflex klystron amplifier were separated by a hybrid-T coupling. The gain of a pair of 3 cm wavelength klystrons was 30 dB with a noise figure of 9.5 dB. D.Walsh

621.385.623.5

7992 FREQUENCY STABILIZATION OF KLYSTRONS. M J.A.Smith.

J. sci. Instrum., Vol. 37, No. 10, 398-9 (Oct., 1960).

Part of the output of the klystron is fed to a mixer, driven by a 60 Mc/s local oscillator, which is itself modulated at 465 kc/s. One of the resulting sidebands is used in a microwave discriminator, and a phase-sensitive detector provides the required error signal. The system is regarded as simpler than the Pound stabilizer, and it avoids the necessity of frequency-modulating the klystron reflector, which is a feature of several alternative schemes. E.A.Ash

621.385.623.5

7993 ISOLATOR EFFECT ON CASCADED REFLEX KLYSTRON AMPLIFIERS. K.Ishii.

Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1503-4 (Aug., 1960).

A reflex klystron can be used as a regenerative amplifier. The gain can be increased by using more than one tube in a cascade arrangement. The stability can be greatly enhanced by using a coupling circuit containing one or more isolators between stages. Experiments are described which indicate that a coupling network consisting of two isolators separated by a phase-shifter can lead to stability without the sacrifice of too much gain. E.A.Ash

621.385.624

7994 A FOUR-CAVITY, ELECTROSTATICALLY FOCUSED, Ku-BAND KLYSTRON AMPLIFIER. R.G.Rockwell.

I.R.E. WESCON Convention Record, Vol. 4, Pt 3, 109-13 (1960).

A new klystron has been developed which has certain interesting features with regards to the number of cavities and the tuner used. It operates at 13.3 Gc/s and weighs about 8 ounces because it is electrostatically focused. The tube is built with four cavities equally spaced along the electron beam, and c.w. power outputs from 1 to 25 W were obtained over the beam voltage range of 800 to 1800 V. The low-level gains ranged from 20 to 35 dB over the same beam voltage range. A novel tuner is used in this tube and is reported for the first time. Slots cut normal to the axis of rotation of a captive nut allow a clamping action to take place, such that no set screw is necessary, yet tuning is easy without backlash. Tubes of this type can be used in Doppler navigators as the transmitter tube, or in parametric amplifiers as a pump tube.

621.385.624

7995 INSTABILITY EFFECTS IN HIGH-POWER C.W. KLYSTRONS. J.C.Vokes and C.P.Lea-Wilson.

J. Electronics and Control, Vol. 8, No. 6, 401-19 (June, 1960).

Some instability effects observed in a four-cavity 2 kW X-band

c.w. klystron amplifier with an efficiency of 40% are described. An explanation of them is put forward, and it is shown that this is capable of accounting for all the major effects observed. The influence of these effects on the design of high-power c.w. klystrons is discussed.

621.385.624 : 621.376.23

USE OF REFLEX KLYSTRONS AS MILLIMETER WAVE DETECTORS. See Abstr. 7899

621.385.624.2

7996 **AN EXPERIMENTAL TWO-CAVITY KLYSTRON.** L.C.Robinson.

Proc. Instn Radio Engrs Australia, Vol. 21, No. 5, 332-5 (May, 1960).

Describes the design, construction and performance of an X-band two-cavity klystron amplifier with waveguide input and output systems. The device is designed for 1 kV operation with 8 to 10 dB low level gain. As an oscillator it has produced power output of 0.6 W at 1 kV.

621.385.63

7997 **AN OCTAVE-BANDWIDTH ULTRA-LOW-NOISE TRAVELING-WAVE AMPLIFIER.** E.W.Kinaman and G.E.St.John.

I.R.E. WESCON Convention Record, Vol. 4, Pt 3, 72-6 (1960).

A noise figure of below 4.8 dB over a 2-4 kMc/s frequency band has been achieved with a travelling-wave tube. A spot frequency value of 2.7 dB was obtained. The electron gun was a hollow-beam version of the type originated by M.R.Currie. D.Walsh

621.385.63 : 621.375.9

7998 **ANALYSIS OF MODULATED TRAVELLING-WAVE DEVICES AND BEAM-TYPE PARAMETRIC AMPLIFIERS.** H.Sobol and J.E.Rowe.

J. Electronics and Control, Vol. 8, No. 5, 321-49 (May,1960).

A general analysis of the beam-modulated travelling-wave tube is given. The modulations are signals applied to the beam in addition to the carrier signal. Modulations are considered at frequencies both very much lower and also at those comparable to the carrier frequency. Large- and small- signal carrier levels are studied. The analysis includes modulation effects on C, QC, b, d, and the initial wave amplitudes. Recommendations for the design of travelling-wave tubes for low modulation-frequency applications are given. The high-frequency analysis is used to analyse the longitudinal-beam parametric amplifier. The upper and lower side-bands around the pump fundamental are considered. Lower gain and more noise than found by previous theories is predicted.

621.385.63

7999 **EXPERIMENTS ON A HELIX BUNCHER TUBE.** N.T.Lavoo.

J. Electronics and Control, Vol. 9, No. 1, 1-29 (July, 1960).

A tube employing travelling-wave synchronous bunching has been investigated experimentally at large signal levels. The experimental tube contained a klystron buncher, a short helix buncher, and a catcher gap. The a.c. current conversion induced by the helix was measured and compared with that induced by the klystron gap. In the ballistic region good agreement with theory was obtained. In the space-charge region the current conversion by the helix was somewhat less than theoretical. Measurement of the large signal gap coefficient of the catcher gap together with the current conversion by the helix indicate an efficiency of 60% should be obtainable. An operating efficiency of 43% was measured in the tube studied even though the output circuit efficiency was only 77%. Thus 56% of the d.c. beam energy was converted onto r.f. energy. The terminated travelling-wave synchronous buncher is characterized by a low power gain so that it is necessary to resort to resonance in order to obtain high power gains.

621.385.632.1 : 538.56

8000 **THEORY OF A MODIFIED SPIRAL WITH REVERSE WINDING.** S.S.Kalmykova and V.P.Shestopalov.

Dokl. Akad. Nauk SSSR, Vol. 133, No. 4, 813-16 (Aug. 1, 1960). In Russian.

The dispersion equation was obtained by the variational method using the concept of spatial resonance. The current distribution was established for this case and compared with the current distribution in the ordinary spiral and in a double spiral with reverse winding. Comparison of dispersion curves of the modified spiral with those of a double spiral with reverse winding shows that in the region of the longitudinal waves $\lambda_g > D$, where D is the period, the differences are small. In the region of the short waves $\lambda_g < D$, these differences become appreciable due to the configuration of the two spirals. The energy density and the harmonic content for the first three components were evaluated and compared with those for an ordinary spiral and for a double spiral with reverse winding. Good experimental agreement with theory is reported.

Z.F.Voyner

621.385.632.1

8001 **COOLING OF THE SLOW SPACE-CHARGE WAVE WITH APPLICATION TO THE TRAVELING-WAVE TUBE.** D.C.Forster.

I.R.E. WESCON Convention Record, Vol. 4, Pt 3, 90-5 (1960).

Coupled-mode theory was used to demonstrate that the inclusion of higher order mixing products does not seriously affect the performance of the space-charge-wave noise exchanger recently proposed by Sturrock "Parametric refrigeration — a mechanism for removal of noise from the slow wave of an electron stream," Microwave Laboratory Report No. 656, Stanford University; October, 1959. Also presented at the International Congress on Microwave Tubes, Munich, Germany; June, 1960. Estimates of the effects of the pump modulation (necessarily induced on the electron stream in the exchanger) on the gain and noise performance of a travelling-wave amplifier were obtained. Noise temperatures on the order of 100°K are indicated if the cathode temperature is assumed to be 1000°K.

621.385.632.1

8002 **LOW-NOISE TRAVELLING WAVE TUBES.** W.Sielanko.

Przeglad Elektron., Vol. 1, No. 1, 26-31 (1960). In Polish.

Two tubes, types LFB5 and LFB6 for two wavebands, are described. Noise factors of 8 and 10.2 dB respectively are quoted but frequency is not indicated. Low noise is achieved by: tetrode type gun, very smooth evenly sprayed cathode, 3% tolerance on spiral pitch, attention to construction of all components. A.Sczaniecki

621.385.632.1

8003 **THE TRAVELLING WAVE TUBE LFB1.** R.Banaszczyk and K.Lewenstein.

Przeglad Elektron., Vol. 1, No. 1, 31-4 (1960). In Polish.

An S-band tube for 20dB amplification at 0.5 W output, based on information gathered from literature. A.Sczaniecki

621.385.632.1

8004 **AN ELECTROSTATICALLY FOCUSED TRAVELING-WAVE TUBE FOR WIDE-BAND AMPLIFICATION IN L- AND S-BAND.** C.L.Cuccia and W.Johnson.

Proc. Nat. Electronics Conf., Vol. 15, 404-13 (1959).

Describes an electrostatically focused travelling-wave tube designed for use in systems requiring wide-band amplification at a power level of 5 W in L- and S-band. The tube uses a convergent-flow gun which projects an electron beam into a bifilar-wound helix. The helix serves as both a slow-wave structure for the travelling-wave tube and a focus mechanism for focusing the electron beam from the exit of the electron gun to the collector. Helical couplers, external to and mechanically separate from the tube envelope, couple r.f. energy to and extract r.f. energy from the bifilar helix. In this tube the bifilar helix is supported by fluted glass tubing which is fused on to the helix to bond each helix turn, resulting in a tube structure which is very rugged. The elimination of focusing structures such as solenoids or permanent magnets makes the tube very light in weight and capable of operation over wide temperature ranges. The use of a bifilar helix as the slow-wave structure provides the wide-band operation characteristic. With one set of fixed operating voltages, the tube operates as an L-band amplifier in the frequency range from 1.3 to 2.0 Gc/s; with another set of fixed operating voltages, the tube operates as an S-band amplifier in the frequency range from 2.0 to 4.0 Gc/s. The collector is designed for depressed-potential operation. However, the tube is capable of operation at a collector potential of a thousand volts less than the synchronous voltage without increase in helix interception or decrease in power output. The new techniques required for the fabrication of this tube and representative electrical characteristics are discussed.

621.385.632.1

8005 A LOW-NOISE TRAVELLING-WAVE TUBE FOR THE 4000 Mc/s BAND. K.B.Niclas and R.Hechtel.
Telefunken-Rohre, No. 36, 75-98 (Oct., 1959). In German.

A standard discussion of low noise tube design is followed by a description of the Telefunken TL 7 tube, which has a noise figure of <7 dB for 20 dB gain in the 4000 Mc/s band.
A.H.W.Beck

621.385.632.1

8006 A TRANSVERSE-FIELD TRAVELING-WAVE TUBE. E.I.Gordon.
Proc. Inst. Radio Engrs, Vol. 48, No. 6 (I), 1158 (June, 1960).

Describes preliminary results on an amplifier using a static spatially varying electric quadrupole field to achieve amplification of the fast cyclotron wave. It appears that in future tubes the theoretical gain may be realized and although the noise figure may not compete with the Adler tube it is expected to be comparable with that of a conventional travelling-wave tube. The advantage of the tube is that the "spent" electrons should be mono-energetic and thus if collected at cathode potential the tube should have high efficiency.
G.D.Sims

621.385.633

8007 A PERIODICALLY FOCUSED BACKWARD-WAVE OSCILLATOR. C.C.Johnson.
I.R.E. WESCON Convention Record, Vol. 4, Pt 3, 103-8 (1960).

The application of some new periodic-focusing techniques to the backward-wave oscillator is discussed. An oscillator utilizing a hollow electron beam was constructed at S-band. A periodic electrostatic-focusing method was used with considerable success, and an octave tuning range was obtained. A periodic magnetostatic-focusing method was attempted with less encouraging results. Interesting effects were observed when the periodic-focusing techniques were applied to the backward-wave oscillator, and some of these are described.

621.385.64

8008 ON THE VOLTAGE-TUNABLE OPERATION OF MAGNETRONS WITH RESISTIVE EXTERNAL CIRCUIT. A.Raev and L.Popova.
C.R. Acad. Bulg. Sci., Vol. 11, No. 6, 441-4 (Nov.-Dec., 1958).

A theoretical property of oscillations due to a rotating space charge cloud is that the anode current should vary as $R^1 = R/(1 + \omega^2C^2R^2)$, where R = load resistance and C = plate capacitance. Thus, the same anode current should be observed for any CR combination giving identical R^1. Experimental verification is given.
A.H.W.Beck

621.385.832

8009 IATRON STORAGE DISPLAY TUBE WITH COAXIAL WRITING AND FLOODING GUNS. M.F.Toohig.
Elect. Commun., Vol. 36, No. 2, 139-43 (1960).

The writing gun is mounted on the axis of the cathode-ray tube, while the flooding gun is in the form of a carefully designed ring assembly, through which the writing beam travels. The determination of viewing time is discussed, and an improved tungsten gettering method described.
B.Meltzer

621.385.832

8010 NOVEL INDICATOR TUBE FOR STEREO TAPE RECORDERS. A.Lieb.
S.E.L. Nachr., Vol. 8, No. 2, 52-4 (1960). In German.

In stereophonic tape recorders, each channel has to be monitored separately. An experimental indicator tube is described which displays two separately controlled patterns that can be viewed at the same time. The simple design of the tube permits reliable manufacture. The tube contains electrode systems for preamplification of the control voltage. The pattern size—voltage characteristic is almost linear. Marks for different ranges of control voltage are provided.

621.385.832

8011 RECENT DEVELOPMENTS IN IMAGE-INTENSIFIER TUBES FOR RADIOLOGY: THE CFTH 16 AND 22 cm TUBES WITH A GAIN OF 3000. L.F.Guyot and B.Driard.
Vide, Vol. 15, 28-35 (Jan.-Feb., 1960). In French.

The new tubes have 3 times the gain of the earlier 16 cm tube, measured relative to a Patterson CB 2 screen. Their lengths are 36 and 42 cm compared with the 24.5 cm of the previous tube. Adaptations for cineradiography as well as the use of closed-circuit television are described.
F.T.Farmer

621.385.832

8012 INFRARED DATA PRESENTATION. R.K.McDonald.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1572-3 (Sept., 1959).

A classification of the display methods used in infrared detection systems. They include cathode-ray tubes and neon-glow tubes.
C.Hilsum

621.385.833

8013 VERY HIGH CONVERGENCE ELECTRON GUNS. D.V.Geppert.
I.R.E. WESCON Convention Record, Vol. 4, Pt 3, 77-89 (1960).

Although Brillouin flow is usually achieved by employing an abrupt magnetic field buildup, it can also be obtained with any type of magnetic field buildup. More importantly, the amount of beam convergence in the region of magnetic field buildup increases with the length of this region. Equations are presented which show that a considerable amount of convergence can be achieved in the buildup region. An area convergence of about 25 to 1 is generally considered the limit for a Pierce gun and abrupt magnetic field buildup. However, experimental tubes in which Pierce guns and slow field buildups were used have demonstrated good d.c. and r.f. characteristics with an area convergence ratio of 130 : 1. There are a number of advantages to using a large rather than a small amount of convergence in the magnetic field buildup region. These include lower cathode-emission density, larger and more reproducible gun structures, less critical entrance conditions, the possibility of using the same gun for different tubes, and higher duty cycle for the same cathode loading.

621.385.833

8014 ON THE CYCLOTRON RESONANCE CHARACTERISTICS OF CROSSED-FIELD BEAMS. Y.Suematsu.
J. Inst. Elect. Commun. Engrs Japan, Vol. 43, No. 5, 597-603 (May, 1960). In Japanese.

Interactions between an electron beam and a TEM wave under crossed-field conditions are most prominent at the cyclotron frequency. This may be utilized for the generation of mm waves without using retarding circuits. The characteristics of the interacting waves were investigated by measuring the absorption of the wave energy by the electron beam. Forward and backward waves were found to be associated with the beam, both having zero rotational energy at the injection. A formula for the centre frequency is derived in terms of the cyclotron frequency, the plasma frequency and the ratio of the electron drift speed to the velocity of light. The frequency responses of the output powers of the forward and backward waves show a main absorption valley and also minor side absorptions. The bandwidth of the main valley of the backward wave is > that of the forward wave. Theoretical results are in fairly good agreement with actual measurements.
A.Wilkinson

621.385.833 : 537.533

8015 THE STABILITY OF COMPUTATION OF THE PIERCE–CAUCHY PROBLEM. B.Meltzer.
J. Electronics and Control, Vol. 8, No. 6, 449-53 (June, 1960).

Limits are found analytically for rate of growth of error in computation — by "marching" methods — of solutions of the finite-difference form of Laplace's equation in two dimensions, with Cauchy boundary conditions. A series of alternative non-marching methods are proposed, which should be stable.

621.385.833

8016 BEAM FOCUSING BY R.F. ELECTRIC FIELDS. E.Sugata, M.Terada, K.Ura and Y.Ikebuchi.
Proc. Inst. Radio Engrs, Vol. 48, No. 6(I), 1170 (June, 1960).

On the assumption of small perturbations, it is deduced that the periodic field pattern of a waveguide propagating an E_{01} wave can focus an electron beam, provided the wave is either backward or — if forward — slower than the electrons. Power requirements are calculated.
B.Meltzer

621.385.833

8017 DETERMINATION OF SIGN OF POWER FLOW IN ELECTRON BEAM WAVES. W.R.Beam.
Proc. Inst. Radio Engrs, Vol. 48, No. 6(I), 1170 (June, 1960).

By considering the transformations of energy in a coordinate system moving with the wave phase velocity (v_1) so that — for

typical electron beams — only quasistatic fields need be considered, the author obtains the condition $v_b/v_i > 1$ for the wave to carry negative power (v_b = beam velocity). B.Meltzer

621.385.833

8018 GENERALIZED BRILLOUIN FLOW. G.Kent.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 144–8 (1960) = Commun. and Electronics, No. 48 (May, 1960).

Some exact solutions are found for the equation of the action function: $\nabla\{(\nabla W + eA).\nabla^2|\nabla W + eA|^{-2}\} = 0$, for a uniform axial magnetic field of vector potential $\underline{A}$. One gives an electron beam of constant forward speed and elliptical cross-section, limiting cases of which are the Brillouin cylindrical and sheet beams. Another is a cylindrical beam with varying forward speed. Some results are found for the Pierce-Cauchy electric fields required outside these beams. However, the beams are not physically realizable, since they have no surface of zero electron velocity. B.Meltzer

621.385.833

8019 AN ELECTRON GUN FOR 0.3 MICROPERV. K.Lewenstein.
Przeglad Elektron., Vol. 1, No. 1, 35-9 (1960). In Polish.

Design details are given of a Müller type gun used in the travelling wavetube LFB1. Current density at the cathode is 40 mA/cm^2 and beam efficiency up to 98%. A.Szaniecki

621.385.833

8020 REDUCTION OF THERMAL NOISE IN ELECTRON BEAMS. C.M.Haaland.
Proc. Nat. Electronics Conf., Vol. 15, 394-403 (1959).

Under certain conditions the time between two events in an electron beam can be considerably shorter than the deflection time as defined by Spitzer [Physics of fully ionized gases. New York; Interscience Publishers (1956) p. 77]. If these conditions prevail, then the electron trajectories will follow paths which are not deflected by collisions. Graphs are presented showing these conditions in terms of voltage, current density and beam length. Because the electrons are not deflected by collisions, the electrons with highest transverse velocities can, in principle, be removed from the beam by interception by an aperture. If equipartitions is then allowed to occur, the temperature of the beam will be reduced. A new expression is developed for the limiting current density in a sheet beam. This expression reduces to that of Pierce's after application of two assumptions.

621.385.833

8021 A PARTIALLY MAGNETICALLY SCREENED ELECTRON GUN FOR A TRAVELLING-WAVE TUBE. R.Johne.
Telefunken-Röhre, No. 36, 65-74 (Oct., 1959). In German.

Describes the design of a converging gun of perveance 1.4×10^{-6} in which the magnetic field lines were adjusted to be coincident with the electron trajectories. The area–convergence ratio was about 15 : 1. The experimental gun gave $P = 1.3 \times 10^{-6}$ and the anode current was less than 0.3% of the beam current. A.H.W.Beck

GAS DISCHARGES
GAS-DISCHARGE TUBES

621.387 : 537.52

8022 HARMONICS FROM A MICROWAVE GAS DISCHARGE. N.R.Bierrum and D.Walsh.
J. Electronics and Control, Vol. 8, No. 2, 81-90 (Feb., 1960).

Harmonic power from a 10 cm wavelength glow discharge in neon was detected down to 6 mm wavelength (18th harmonic). The fundamental power was fed from the waveguide to a coaxial line terminated by the discharge tube. A second smaller waveguide was coupled to the coaxial line to extract the harmonic power. With careful matching at each wavelength, the conversion loss appeared to fall off by only 3-4 dB per harmonic after an initial drop of 35 dB to the third harmonic (lowest harmonic measured). A typical conversion loss from 10 cm to 8 mm (12th harmonic) was 63 dB, e.g. 20 kW input, 10 mW output. In general the output power increased with input power until arcing in the mount spoiled the measurement. A pressure range of 5-39 mm Hg was used.

621.387 : 537.52

8023 EXCITATION IN A TRANSIENT ARC DISCHARGE. A.M Howatson.
J. Electronics and Control, Vol. 8, No. 6, 441-7 (June, 1960).

The intensity ratio of two copper emission lines was measured as a function of time for a transient arc in free air, using two photomultipliers simultaneously. The results are compatible with the thermal nature of the high-pressure arc, but indicate that for temperature measurement the usual assumption of Boltzmann populations may not be sufficient in an unsteady discharge of this type.

621.387

8024 SPARKOVER AS INFLUENCED BY SURFACE CONDITIONS IN D.C. CORONA. G.W.Penney and S.E.Craig.
Trans. Amer. Inst. Elect. Engrs. I, Vol. 79, 112-18 (1960); Commun. and Electronics, No. 48 (May, 1960).

Reports results of experiments performed to determine the effects of contamination of electrodes and electrode size upon sparkover voltage in both positive and negative corona regions. With negative corona there appeared to be a correlation between the sparkover voltage and the resistivity of any deposit on the passive (large) electrode. With positive corona high-resistivity material on the passive electrode had a smaller effect and the correlation with resistivity was less pronounced. On the other hand high-resistivity material on the active (small) electrode had a small effect with negative corona and a very large effect with positive corona. These results would seem to show that the anode surface condition is the element of primary importance in determining the sparkover voltage. With positive corona any high-resistivity material on the active electrode gave a large reduction in sparkover voltage when the active electrode, in the form of a wire, was of the order of 0.1-in. diameter, however with a wire of less than 0.012-in. diameter the effect was much smaller. Sparkover at relatively low voltage-gradients was preceded by current pulses that characteristically rose to a peak in about 0.1 μs and decayed to a low value in 0.5 μs. R.Hawley

621.387

8025 CURRENT–VOLTAGE RELATIONSHIPS IN NEGATIVE PULSED CORONA. J.B.Thomas and T.R.Williams.
Trans. Amer. Inst. Elect. Engrs I, Vol. 79, 136-9 (1960); Commun. and Electronics, No. 48 (May, 1960).

Using a fixed cylindrical electrode structure, the current–voltage relationships of negative pulsed corona were obtained for a wide range of pulse lengths and repetition rates and for various values of load capacitance. It was shown that with negative pulse energization it was possible to obtain corona losses of the same order as for the d.c. case, even with relatively low duty cycles. At the same time peak voltages considerably in excess of the d.c. sparkover value could be maintained. For a fixed corona-cell electrode structure pulse energization would permit the selection of a wide range of current–voltage characteristics which could be changed by varying the pulse length, the pulse repetition rate and the load capacitance. R.Hawley

621.387 : 621.316.722 : 537.52

8026 NOTES ON THE DESIGN OF GLOW DISCHARGE VOLTAGE STABILIZERS FOR PHOTOMULTIPLIER TUBE POWER SUPPLIES. L.K.Neher.
Nuclear Instrum. and Methods, Vol. 5, No. 2, 95-100 (Aug., 1959).

A series of high stability neon glow discharge tubes (OG3/85A2) was used to stabilize 1685 volts for the dynode resistance divider of a photomultiplier tube to an accuracy of ±0.2%. The limit of stability and the ageing phenomena for the tube operating at reduced currents are discussed but not understood.

621.387

8027 A SIMPLE ARRANGEMENT FOR DISPLAYING THE EXCITATION CONDITIONS IN GLOW GAPS AND DISCHARGE LAMPS. M.Wilk.
Z. Naturforsch, Vol. 15a, No. 7, 642-3 (July, 1960). In German.

A very brief note explaining a simple method for displaying, with a cathode-ray oscillograph, current changes in a glow discharge on effectively a voltage scale. Capacitive coupling to the discharge is used. The oscillograms show "Franck–Hertz" dips. J.D.Craggs

621.387 : 621.315.1

SURGE CORONA DISCHARGE. See Abstr. 7265

621.387.42

8028 SOME TECHNOLOGICAL PROBLEMS IN GEIGER–MÜLLER TUBES AND SPARK COUNTERS. W.Espe and A.Kuhn.
Slaboproudy Obzor, Vol. 21, No. 5, 288-93 (1960). In Czech.

The paper is principally concerned with gas fillings for tubes and counters. Geiger–Müller tubes are divided into three classes: (a) slow self-quenching devices filled with Ar at about 100 mm Hg; (b) fast self-quenching tubes filled with a base gas (usually pure Ar) and a quenching mixture (gas); and (c) low-voltage tubes which are normally filled with Ne with a small quantity of Ar and a halogen as the quencher. Fast tubes employ a variety of quenching substances; the physical properties of these are indicated in a table. Three types of spark counter are mentioned. These are usually filled with Ar and xylene, but other mixtures are possible. A method of preparing $B(CH_3)_3$, which is often used as the quenching substance, is described. Methods of filling Geiger–Müller tubes with a base gas and a quencher are briefly discussed. R.S.Sidorowicz

621.387.464 : 539.1.07

8029 THEORY OF TIME RESOLUTION IN SCINTILLATION COUNTERS. E.Gatti and V.Svelto.
Nuclear Instrum. and Methods, Vol. 4, No. 4, 189-201 (May, 1959).

Four methods of handling the output pulse current of a scintillation counter, for extracting time information, have been theoretically compared. Final graphs are given for the time resolution, which can be obtained with the four methods, as a function of parameters that describe the multiplier phototube and the scintillator.

621.387.464 : 621.383.27 : 539.1.07

THE SCINTILLATION COUNTER. See Abstr. 7943

ELECTRONIC EQUIPMENT

621.389

8030 A STATISTICAL METHOD FOR LIFE PREDICTION OF TELECOMMUNICATION EQUIPMENT. H.Störmer.
Arch. elekt. Übertragung, Vol. 14, No. 5, 217-24 (May, 1960). In German.

The life of an equipment is defined as the period between the beginning of the work and the first failure, i.e. the first breakdown of a component. When average lives of all components are known and the life distribution of components can be assumed exponential, it is easy to find the life distribution of the entire equipment. An analysis is made of a more complicated case when the average life of components is not known accurately but has been determined on a limited number of samples. An example is given to illustrate the practical application of the analysis. J.M.Silberstein

621.389

8031 INITIAL PRODUCTION RELIABILITY OF DEVICES. Ya. A.Rips.
Avtomat. i Telemekh., Vol. 20, No. 6, 813-22 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 6, 788-97 (June, 1959: publ. Feb., 1960).

A method is suggested for determination of the initial production reliability, the magnitude of which is determined by design peculiarities of the device and by production factors. Analytical expressions for computational purposes are deduced, and the relationship is shown between the initial production reliability and the rated safety factors. The effects of additional inspection and finishing are considered, and an engineering method for taking these into account is provided, this method approximating the distribution law by a series of normal distribution laws and their linear combinations.

621.389

8032 MATHEMATICAL-MODELS FOR SYSTEM RELIABILITY. I-II. R.E.Barlow and L.C.Hunter.
Sylvania Technol., Vol. 13, No. 1, 16-31 (Jan.); 55-65 (April, 1960).

Presents a workable method for determining the reliability of large, complex systems. Repair is an integral part of the model proposed and the usual assumption of component independence is not made. In recognition of the stochastic nature of the time between failures in an electronic system, the reliability of any system is defined in terms of a suitable stochastic process. If component failure and repair parameters are known, the reliability of the system can be calculated easily. Conversely, for a known reliability requirement for the system, determination of permissible values for the mean time-to-repair and the mean time-to-failure of each component is a routine calculation. Certain specific applications of the generalized concepts are included. In pt II, a reliability analysis is made of a less complex system (redundant circuits), each of whose components may fail in one of two ways. Two types of preventive maintenance policies are considered to investigate the repair feature of the model more fully. The optimum times to perform preventive maintenance are, in each case, unique solutions of certain integral equations depending on the failure distribution. In addition, a related problem, that of optimal checking procedures, is solved for a class of failure distributions.

621.389 : 620.1

8033 THE FACTORS RESPONSIBLE FOR THE DETERIORATION OF ELECTRONIC EQUIPMENT. J.M.Alameda.
Rev. Cienc. apl., Vol. 14, No. 2, 121-9 (March-April, 1960). In Spanish.

A classification, in tabular form, of mechanical, climatic and physical–chemical causes of damage, with indications of the interactions between groups of conditions. W.G.Stripp

621.389

8034 SYNTHESIS OF FAILURE-INDICATING MODULES. D.H.Breslow.
Proc. Nat. Electronics Conf., Vol. 15, 645-55 (1959).

Equipment repair time may be minimized by the use of failure indication modules (f.i.m.). F.I.M. are a group of parts that perform some equipment function as well as provide a signal to indicate when that function is not being performed in a satisfactory manner. The fail indication signal may then be used to rapidly isolate the defective module. A component called a comparator network has been developed to convert ordinary modules into the f.i.m. type. This device plugs into a standard-seven-pin miniature tube socket and samples up to two independent waveforms, compares each against externally derived d.c. reference voltages, and changes the state of its single output line from positive to negative should either signal deteriorate below its preset limit. Outputs of as many comparators as are necessary may be stacked in parallel. The methods used to apply the flexible building block logic of the comparator to synthesize failure-indicating modules are discussed in detail.

621.389

8035 USING FAILURE DATA FOR COMPONENT-PART DERATING. I.Doshay.
I.R.E. WESCON Convention Record, Vol. 4, Pt 6, 52-9 (1960).

The use of failure data on previously designed equipment is suggested for application in derating component-part applications in new designs. Certain component-part types have been found to exhibit tendencies to become high-failure-rate items. A means of segregating these items through histogram analysis is used to obtain data on normal and abnormal expectancy. A method of applying such data is explained by example.

621.389

8036 RELIABILITY OF ELECTRONIC EQUIPMENT. H.J.Fründt.
Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 9, 338-41 (April 25, 1960). In German.

Failure rates of electronic equipments are generally constant. Mean operating time, i.e. the statistical mean time between any two failures, used as a measure of reliability, can be predicted if the failure rate of individual components is known: it can furthermore be used in calculating the probability of trouble-free operation for a given time. Since the failure rate of individual components depends greatly on environmental conditions, it is desirable, in the interest of reliability, to plan for minimum demands on components with respect to ratings and tolerance effects on circuit operation. Failure rates of commonly used components are tabulated and also plotted against temperature and rating: a plot of survival probability is also given. 5 references. A.Reiss

621.389

8037 LIMITING DIMENSIONS OF ELECTRIC ELEMENT WINDINGS. S.P.Kolosov.
Avtomat. i Telemekh., Vol. 20, No. 6, 808-12 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 6, 783-7 (June, 1959: publ. Feb., 1960).

The possibility is considered of decreasing the dimensions of electric element windings at the expense of increasing their temperature rise. It is established that, due to the effect of the resistance–temperature coefficient, these dimensions can be decreased only down to a definite minimum.

621.389

8038 ELECTRO-OPTICAL SWITCHING DEVICE.
Electronics, Vol. 33, No. 33, 152, 154 (Aug. 12, 1960).

Short description of this device, which uses a neon tube to drive a photoresistor. Typical characteristics of the "Raysistor" are given and its expected life. A table compares the characteristics of a raysistor with those of a transistor, a thyratron and a conventional relay. The application of a raysistor in a spectrum analyser is briefly described. C.J.M.Benard

621.396

8039 HUMAN MAINTENANCE FUNCTIONS IN MAN-MACHINE SYSTEMS. M.A.Grodsky and G.W.Levy.
I.R.E. WESCON Convention Record, Vol. 4, Pt 4, 179-80 (1960).

The importance of a mathematical model of maintenance behaviour is discussed in terms of the design of equipment and the training of personnel. The general assumptions of such a model are presented in terms of a system concepts, the criteria for good maintenance and the human behaviours involved. The assumptions of the model are closely related to recent work in the theory of signal detectability. Justifications and the applications of the model are presented along with an experimental programme.

621.389

8040 MEASURING HUMAN INTERACTION IN MAN-MACHINE SYSTEMS. A.M.Freed.
I.R.E. WESCON Convention Record, Vol. 4, Pt 4, 189-201 (1960).

621.389

8041 A SYSTEMATIC APPROACH TO COMPLEX ELECTRONIC EQUIPMENT MAINTENANCE REQUIREMENTS. J.J.Brown, J.H.S.Chin and G.W.Jacob.
I.R.E. WESCON Convention Record, Vol. 4, Pt 6, 3-14 (1960).

A complex shipboard electronic equipment incorporating modular packaging is analysed for maintenance considerations. Test facilities are determined by maintenance philosophy, the number of spares, and calculation of predicted failure rates. A demand factor is calculated based upon failure rates, system population, and operating or mission periods. Module replacement versus module repair is dependent upon cost, down time, and complexity of repair facilities. The latter approach, however, may be modified to yield an acceptable solution when a test facility and selected spare modules are used.

621.389

8042 THE ENGINEERING CONTRIBUTION TO PRODUCT QUALITY. W.C.Kraft.
I.R.E. WESCON Convention Record, Vol. 4, Pt 6, 43-51 (1960).

621.389 : 681.142

8043 AUTOMATIC PROGRAMMING OF GROUND SUPPORT CHECKOUT EQUIPMENT USING COMPUTER TECHNIQUES. M.Cook and C.Keller.
I.R.E. WESCON Convention Record, Vol. 4, Pt 6, 129-35 (1960).

Two methods of preparing operational test routines for automatic test equipment are contrasted. Conventional methods of preparing computer programmes routines are compared with a new concept, using a computer to select punched card configuration and to prepare tapes for automatic control of key punching equipment.

621.389

8044 THE EFFECTIVE RANGE OF A NUCLEAR EXPLOSION FOR ELECTRONIC EQUIPMENT. J.R.Crittenden.
I.R.E. WESCON Convention Record, Vol. 4, Pt 6, 141-7 (1960).

A short, intense pulse of nuclear radiation can produce disturbances in electronic devices. The transient may seriously affect the performance of electronic circuits and equipment. Analysis of the transient disturbances indicate that a short, intense pulse of nuclear radiation creates low resistance electrical leakage paths. The effect is to distort circuit performance for the duration of the anomaly. Comparison of experimental pulse intensities with the pulse emitted by a nuclear explosion reveals that equivalent conditions exist at surprisingly great distances — extending the effective range of the explosion more than five times.

621.389 : 534.1

8045 FORCED OSCILLATION OF A SPRING–MASS SYSTEM HAVING COMBINED COULOMB AND VISCOUS DAMPING. E.S.Levitan.
J. Acoust. Soc. Amer., Vol. 32, No. 10, 1265-9 (Oct., 1960).

An analytic solution for the response of the support-excited system is presented. The solution to the equation of motion is developed through the application of a Fourier Series to represent the frictional force opposing the relative motion between mass and supporting structure. It is assumed that no stops occur during any portion of the steady-state oscillation. The results are presented in a form convenient for observing the influence of system parameters.

621.389

8046 INDUSTRIAL, TECHNICAL, AND MEDICAL APPLICATIONS OF INFRARED TECHNIQUES. P.J.Ovrebo, R.R.Sawyer, R.H.Ostergren, R.W.Powell and E.L.Woodcock.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1629-45 (Sept., 1959).

Infrared spectroscopy is used in many different fields. These are listed and some details given of the specific problems which have been attacked. A comparison is made between the spectrometer and the non-dispersive analyser. A special form of the non-dispersive analyser is the absorption hygrometer. Infrared pyrometers and radiometers are described. They can be used for measuring temperatures only a few degrees above ambient, and find application in detecting fires in aircraft and overheated axle boxes on trains. Infrared image tubes have been used for diagnosing breast tumours and phlebitis. C.Hilsum

621.389

8047 THE DESIGN, INSTALLATION AND OPERATION OF ELECTRONIC EQUIPMENT IN SERVICE AIRCRAFT. N.R.Bennett and W.M.Rice.
Proc. Instn Radio Engrs Australia, Vol. 21, No. 5, 323-31 (May, 1960).

621.389

8048 HEAT TRANSFER AND FLUID FLOW FOR AIRBORNE NAVIGATION SYSTEM. J.F.Culverwell.
Proc. Nat. Electronics Conf., Vol. 15, 807-13 (1959).

Heat transfer test data correlations are presented for three types of airborne electronic temperature control equipment; a plate fin exchanger for cooling gas with a boiling liquid, a transistor fintube with heat removed from both a gas and the transistors by a boiling liquid, and direct heat removal from electronic components by a gas.

621.389

8049 PRINTED CIRCUITS CONTAINING RESISTORS. I. P.A.B.Toombs.
Brit. Commun. and Electronics, Vol. 7, No. 9, 666-70 (Sept., 1960).

Printed circuits remove the difficulty of wiring. It is now possible to manufacture both wiring and resistors by this technique. Up to the present the maximum resistance per square is low. A method is described whereby this resistance per square can be increased. A.C.Brown

621.389 : 621.315.61

ACCELERATING FACTORS OF THE SIMULATING "CYCLED HUMID HEAT" TEST FOR DIELECTRICS AS COMPARED WITH ATMOSPHERIC EXPOSURE IN HUMID TROPICS. See Abstr. 7391

621.389.049.75

8050 SURFACE PROTECTION OF PRINTED CIRCUITS. N.Bartoňová.
Slaboproudy Obzor, Vol. 21, No. 9, 547-9 (1960). In Czech.

The problem of protecting the contact surfaces of the switches designed for printed circuits was investigated experimentally. It

was aimed at achieving long life, adequate mechanical strength and absence of corrosion of the contacts. Two methods of contact protection were devised: (1) galvanic coating of the surface with hard silver; and (2) galvanic plating with hard silver and a passivating layer of rhodium. Both methods are described in detail. The second method proved entirely successful in that a life in excess of 20 000 revolutions with a load of 300 g could easily be achieved for the switches so protected. R.S.Sidorowicz

621.389

8051 SURFACE PASSIVATION AS APPLIED TO MICROCOMPONENTS. T.C.Hall.

I.R.E. WESCON Convention Record, Vol. 4, Pt 3, 129-32 (1960).

A new approach to semiconductor micro-component packaging employing surface passivation is presented. The term "passivation" is defined to mean the generation on the semiconductor surface of a strongly-bound chemical film layer which does not adversely affect those surface electronic properties leading to acceptable device characteristics. In addition, a condition of electrical stability of the surface is provided, together with isolation from those electrical and chemical environmental influences leading to change in device characteristics. The merits of the new approach in contrast to conventional hermetic packaging are considered. Experimental results demonstrating the superior device performance-reliability characteristics of diode structures treated in this manner are discussed. In addition to improved device performance and reliability, significant and critical advantages in microminiaturizing and device fabrication are realized.

621.389.049.75

8052 A SURVEY OF THE FUTURE OF MICROCIRCUITRY. W.A.Adcock.

Proc. Nat. Electronics Conf., Vol. 15, 624-9 (1959).

621.389.049.75

8053 MICROCIRCUITRY APPLICATIONS OF EVAPORATED MATERIALS. D.W.Moore.

Proc. Nat. Electronics Conf., Vol. 15, 630-9(1959).

Describes the preparation of evaporated films of dielectric, magnetic and resistive materials, and shows how they may be used in the fabrication of highly miniaturized circuitry. The preparation of solid-state circuits and circuits with lumped and distributed constants is outlined in detail. The high-vacuum thermal evaporator is used as a means of producing in large quantities thin films of practically any material. The increasing use of high-temperature materials further stresses the need for the evaporator because it is the most feasible forming method for many of the ceramic materials. The applications of thin films to the future development trends are explored.

621.389.049.75

8054 WAYS TO MICROMINIATURIZATION. W.Hennig.

Elektronik, Vol. 9. No. 6, 163-7 (June, 1960). In German.

A review, with numerous illustrations, of developments, from Project Tinkertoy to recently produced complete circuits (e.g. a multivibrator) on a piece of semiconductor 4mm × 7mm in size, and even units made up of molecular layers. A list of establishments engaged in production and development, and 28 references, are given. W.G.Stripp

621.389.049.75

8055 ELECTRON BEAM PROCESSES FOR MICROCIRCUIT FABRICATION. T.Maguire.

Electronics, Vol. 33, No. 29, 59-63 (July 15, 1960).

Electron beam techniques for the formation of complete semiconductor circuits within a vacuum system are discussed generally. Some of the problems involved and present development work are considered. A.C.Brown

621.389

8056 THE HUGHES TYPE I MICROELECTRONIC CIRCUIT CONCEPT. B.G.Bender, W.B.Warren, R.A.Gudmundsen, and E.L.Steele.

I.R.E. WESCON Convention Record, Vol. 4, Pt 3, 136-42 (1960).

This circuit concept is based upon diodes, transistors, resistors, and capacitors packaged within an envelope essentially 0.050 in. diameter × 0.030 in. thick, and a perforated circuit board within which the components are contained and on the two surfaces of which the interconnecting circuitry is carried. The system is demonstrated through its application to an 85-component computer full-adder wherein the importance of interconnecting circuitry is made evident. While, in several systems, packing densities of the order of millions of components per cubic foot are readily achievable in relatively small aggregates of components, it is shown that computer-type circuitry requires intergroup communication which absorbs increasingly greater percentages of total volume as the number of components is increased. Means for producing packing densities of the order of 670 000 components/ft^3, while retaining accessability to components under operating conditions, and for radical reduction in interconnection joints are shown.

621.389

8057 A CODED AUTOMATIC DOOR RELEASE. J.D.Storer.

Electronic Engng, Vol. 32, 617-19 (Oct., 1960).

A simple combination lock is described. It is operated by push-buttons marked with the letters of the alphabet: four letters having to be selected in the correct sequence. The circuit consists of uniselectors and relays.

MEDICAL ELECTRONICS

621.389

8058 AN ULTRASONIC FLOWMETER. J.F.Herrick and J.A.Anderson.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 195-7 (Dec., 1959).

For measuring blood flow without opening the system the ultrasonic method has the following advantages: (1) it is speedy; and (2) the frequency selected (about 400 kc/s) is not associated with any naturally occurring parameter within the living animal. Two ceramic transducers spaced about 1 in. apart along the vessel operate alternately as transmitter and receiver and the difference in transit time between go and return is a measure of the flow velocity. This difference is about 2×10^{-8} sec or 0.03° phase angle, calling for exceptional sensitivity and stability. A major difficulty is the establishment of the zero since it is considered undesirable to stop the flow for this purpose. H.G.M.Spratt

621.389

8059 DESIGN CONSIDERATIONS FOR ULTRASONIC FLOWMETERS. W.R.Farrall.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 198-201 (Dec., 1959).

Describes a flowmeter using 380 kc/s barium titanate transducers. Two transmitting and two receiving transducers of cylindrical shape with a lengthwise slit through which the vessel, momentarily collapsed, is pushed,are employed and these are arranged in pairs about 1 in. apart. A phase-measurement technique is used to determine the transit time. Considerable difficulty was experienced in matching the transducers and in eliminating parasitic oscillation and crosstalk. Reducing zero-shift remains an unsolved problem. H.G.M.Spratt

621.389

8060 A PULSED ULTRASONIC FLOWMETER. D.L.Franklin, D.W.Baker, R.M.Ellis and R.F.Rushmer.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 204-6 (Dec., 1959).

The sensing unit of the instrument is a split Lucite cylinder which is clamped round the blood vessel. Two barium titanate transducers are mounted in the cylinder so that pulses of 3 Mc/s ultrasonic waves, at 800 pulses/sec, are transmitted alternately upstream and downstream. The voltage developed, which is proportional to the difference in the two transit times, is recorded continuously. The voltage/flow-volume relationship is linear and accurate to within ±5%, independent of velocity fluctuations. The maximum noise and baseline drift, measured over a 4 hr period, is equivalent to a velocity variation of less than 1 cm/sec. H.G.M.Spratt

621.389

8061 COMPARATIVE PULSATILE BLOOD FLOW CONTOURS DEMONSTRATING THE IMPORTANCE OF RC OUTPUT CIRCUIT DESIGN IN ELECTROMAGNETIC BLOOD FLOWMETERS. T.Cooper and A.W.Richardson.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 207-9 (Dec., 1959).

When using such a flowmeter fed from a 60 c/s source in combination with a pen recorder to record the rectified output, difficulty was experienced in designing circuits which gave an output free from ripple and with a sufficiently short rise time. As a result three circuits were investigated of which the most satisfactory embodies a centre-tapped output transformer feeding via a diode bridge into a 120 c/s rejection filter. The rise time was found to be 12 msec., — compared with 10 msec. for the recorder — and the ripple voltage 2%. H.G.M.Spratt

621.389

8062 GATED SINE-WAVE ELECTROMAGNETIC FLOWMETER. A.Westersten, G.Herrold, E.Abbott and N.S.Assali.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 213-16 (Dec., 1959).

With such a flowmeter, the use of d.c. magnetization calls for non-polarizable electrodes while square-wave magnetization gives rise to transients which can overload pre-amplifiers. The use of sinusoidal magnetization causes the generation of an induced voltage in the pick-up electrodes and their leads. However, this induced voltage is in phase-quadrature with the flow e.m.f. Accordingly, by sampling the latter once per cycle over a period, starting just before the maximum value is reached and finishing at an equal time interval afterwards, and then integrating, the phase-quadrature component is eliminated. Several designs of sensing elements are described, including a hinged unit for slipping over the vessel. Earth-loop currents around the pick-up electrodes are bypassed by the provision of guard rings. H.G.M.Spratt

621.389

8063 CHOPPER-OPERATED ELECTROMAGNETIC FLOWMETER. F.L.Abel.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 216-19 (Dec., 1959).

A commercial pulse generator triggered by a free-running waveform generator provides a square-wave signal which feeds into a 70 W amplifier to drive the magnet system of the sensing unit. Signals from the electrodes are amplified and then chopped by a mechanical chopper which is synchronized with and delayed as necessary by the pulse generator. By this means the amplifier is gated off for about 0.02 ms during each switching period and transients are blocked. The chopper output passes via a low-pass smoothing filter to a cathode-follower output stage. Good frequency response, stability and signal–noise ratios are obtained. The sensitivity is sufficient to measure flow levels of 1 ml/min. H.G.M.Spratt

621.389

8064 THE SQUARE-WAVE ELECTROMAGNETIC FLOWMETER: THEORY OF OPERATION AND DESIGN OF MAGNETIC PROBES FOR CLINICAL AND EXPERIMENTAL APPLICATIONS. M.P.Spencer and A.B.Denison, Jr.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 220-8 (Dec., 1959).

This flowmeter operates by producing an alternating magnetic flux across the exposed vessel and at the same time measuring the resulting voltage developed across the vessel. This voltage is proportional to the flow velocity, the field strength and the length of the conductor (i.e. the vessel diameter). The magnetizing waveform is square-shaped since d.c. magnetization calls for non-polarizable electrodes and noise signals cannot be eliminated, while a sinusoidal magnetization introduces a transformer effect. The electrode voltage is sampled once during each half-cycle so that the voltage spikes on field reversal can be eliminated. Three designs of probe and a series of oscillograms indicating the electrode voltage output are shown. An accuracy figure within ±8% is claimed. H.G.M.Spratt

621.389

8065 ELECTROMAGNETIC BLOOD FLOW MEASUREMENTS IN EXTRACORPOREAL CIRCUITS. A.R.Cordell and M.P.Spencer.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 228-31 (Dec., 1959).

(See also preceding abstract). Describes the application of the square-wave flowmeter, in combination with a pump, to extracorporeal circuits, where the blood flows through a short stainless steel tube made integral with the probe(sensing device). Calibration can be effected by utilizing blood of a known hematocrit or alternatively by passing the blood through a graduated cylinder and measuring the flow over a specific period. A bypass to the probe enables the flowmeter zero to be checked. H.G.M.Spratt

621.389

8066 A MAGNETIC FLOWMETER FOR RECORDING CARDIAC OUTPUT. H.W.Shirer, R.B.Shackelford and K.E.Jochim.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 232-4 (Dec., 1959).

(See also two preceding abstracts). Describes an elaboration of the square-wave flowmeter of Spencer and Denison. A 480 c/s carrier frequency is employed in order to ensure a uniform frequency response up to at least 100 c/s. The narrow output pulses from the gate are widened in a pulse stretcher and then passed through a ring demodulator and a low-pass filter. D.C. output amplifiers act an impedance transformers and permit both instantaneous and mean flow measurements. Details of the frequency response and equivalent noise are given. H.G.M.Spratt

621.389

8067 THE D.C. ELECTROMAGNETIC FLOWMETER AND ITS APPLICATION TO BLOOD FLOW MEASUREMENT IN UNOPENED VESSELS. W.Fedev and E.B.Bay.

I.R.E. Trans Med. Electronics, Vol. Me-6, No. 4, 240-5 (Dec., 1959).

The major difficulties in the design of these flowmeters are the provision of non-polarizable electrodes and the achievement of high stable d.c. amplification. Electrodes are studied in detail, including calomel and silver–silver chloride types. Three types of polarization, ohmic, concentration and activation, are recognized and discussed. Hyflux Alinco V magnets are employed. The amplifier is a transistorized differential d.c. unit. Drift amounts to 2 μV per hour for low-impedance signal sources. H.G.M.Spratt

621.389

8068 AN INTEGRATING DROP-FLOWMETER FOR OPTICAL OR PEN RECORDING. C.N.Peiss and R.D.McCook.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 234-7 (Dec., 1959).

The drops of blood pass through a flow chamber and are sensed by a photocell. The photocell output is amplified, differentiated and then used to trigger a thyratron, so producing a uniform pulse. The pulses are integrated and pass to a galvanometer, c.r.o. or a pen recorder. Calibration is effected by triggering the thyratron from a l.f. pulse generator. Linearity is achieved over a range of 1-10 pulses/sec. H.G.M.Spratt

621.389

8069 PERFORMANCE AND APPLICATION OF A COMMERCIAL BLOOD FLOWMETER. W.Thornton and B.Bejack.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 237-40 (Dec., 1959).

The instrument uses a 60 c/s square-wave supply to the probe which consists of a U-core with half the windings on each leg, each half being energized alternately every half-cycle. A chopper is used to sample the amplified e.m.f. developed across the sensing electrodes during the "flat" period of each half-cycle. A regulated power supply is provided. All probes can be autoclaved without sustaining damage. Figures for stability, sensitivity, linearity and response time are given. H.G.M.Spratt

621.389

8070 FLOWMETER FOR EXTRACORPOREAL CIRCULATION. G.Albertal, R.H.Clauss, A.M.Fosberg and D.E.Harkens.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 246-8 (Dec., 1959).

This instrument is designed for use with artificial heart–lung devices. The sensing unit is of the electromagnetic type with 60 c/s sinusoidal magnetization and the meter is a self-balancing chart recorder. The two units are connected together by cables which can be up to 100 ft long. The meter is unaffected by supply voltage changes of ±10% and the calibration accuracy is within ±1%. The flow conduit is Teflon-lined and is sterilized with ethylene oxide gas. H.G.M.Spratt

621.389

8071 ORIFICE-PLATE FLOWMETER FOR EXTRACORPOREAL CIRCUIT. F.Robicsek.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 249 (Dec., 1959).

A brief description of a flowmeter used for routine open-heart operations. The pressure differential arises from a moderate constriction in the fluid conduit and is a measure of the flow. The sensing unit is constructed of silicone-coated stainless steel with a changeable Teflon orifice plate. The differential pressure is measured with a standard Statham Pb pressure gauge. H.G.M.Spratt

621.389

8072 METHODS OF FLOW ESTIMATION BY PRESSURE SENSING TECHNIQUES. D.L.Fry.
I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 264-6 (Dec., 1959).

The characteristics of eight different techniques involving pressure or drag measurements are tabulated. These include the use of Venturi tube, an elbow meter, pitot tube and a rotameter. Two additional projected methods are discussed: (1) the use of a single-lumen catheter to estimate the beat-to-beat stroke volume of flow without regard to the shape of the velocity wave, a promising technique; and (2) the use of the central pulse method of computing stroke output, a technique which requires estimation of the properties of the entire vascular system. H.G.M.Spratt

621.389

8073 BLOOD FLOWMETER UTILIZING NUCLEAR MAGNETIC RESONANCE. R.L.Bowman and V.Kudravcev.
I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 267-9 (Dec., 1959).

Several variants of this technique are possible. The one favoured is to induce resonance in hydrogen protons and design the apparatus so that the relaxation time is comparable with the time required for the nucleus in the flowing liquid to pass through the resonance region and the degree of interaction is limited by flow. A permanent magnet provides the necessary field across the flow tube and this field can be varied by current passing through coils wound round the pole caps. A further coil wound round the flow tube is coupled to an oscillator detector whose anode current changes when resonance occurs. Curves show output signal amplitude versus flow-rate of water under various conditions. No blood flow measurements are mentioned. H.G.M.Spratt

621.389

8074 THE POTTER ELECTROTURBINOMETER: AN INSTRUMENT FOR RECORDING TOTAL SYSTEMIC BLOOD FLOW IN THE DOG. S.J.Sarnoff and E.Berglund.
I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 270-4 (Dec., 1959).

The instrument consists of a $\frac{1}{2}$ in. dia. turbine without bearings, embodying a 2-pole magnet, which is inserted in the blood vessel. As the magnet rotates, current pulses are induced in an externally located pick-up coil which can be connected to either a recording instrument or a Veeder–Root counter, so indicating the number of turbine revolutions in a given time. Calibration was carried out on an external system using water and blood dilutions. The instrument is insensitive to temperature, changes from steady to pulsating flow and wide changes in dilution, i.e. viscosity. Its disadvantages are the necessity for applying an anticoagulant and an undesirably high resistance to flow. H.G.M.Spratt

621.389

8075 AN AUTOMATIC RECORDING BUBBLE FLOWMETER. C.W.Nash and J.V.Milligan.
I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 274-6 (Dec., 1959).

Blood from a cannulated vessel flows through plastic tubing and back to the blood vessel. The flow causes a compression in a bubble trap and an air bubble is injected into the blood stream. The bubble passes with the blood flow through the field of view of a photocell and is then caught by the bubble trap. The photocell pulse is used to energize a solenoid and inject another bubble. Each bubble injection is sensed as a pressure impulse and recorded on an oscillograph. Calibration is accurate to within ±5% at a flow rate of 200 ml/min. The insertion resistance of the instrument is negligible. H.G.M.Spratt

621.389

8076 HARMONIC ANALYSIS OF FREQUENCIES IN PULSATILE BLOOD FLOW. D.J.Ferguson and H.S.Wells.
I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 291-4 (Dec., 1959).

A study of the frequency-band requirements. As a basis, it is specified that sufficient harmonics should be measured and recorded to total up to within 2% of the true flow at all points in the cycle. On this basis, the highest frequency requirement was found to occur in the case of the pattern of the flow in the ascending aorta of an anaesthetized dog where 21 harmonics were significant corresponding to a maximum frequency of 52.5 c/s. Phase response is not mentioned. H.G.M.Spratt

621.389

8077 USE OF INDICATOR CONCENTRATION CURVES IN COMPUTATION OF MEAN RATE OF FLOW AND VOLUME OF BLOOD CONTAINED WITHIN A SEGMENT OF THE VASCULAR SYSTEM. H.D.Green, A.B.Denison, Jr, C.E.Rapela and G.Lin.
I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 277-82 (Dec., 1959).

A study of the technique of flow measurement by injecting an indicating fluid at one point in a vessel and measuring the time elapsing before it is sensed at another point downstream. A hypothesis is presented concerning the motion of the indicator followed by a mathematical analysis of the resulting indicator concentration curve at the sensing point. It is concluded that the technique can be used to measure both mean flow, provided the sample analysed is representative of the whole cross-section of the vessel at the sampling point, and also mean transit time. Blood and indicator must, however, be continuously mixed at both points. H.G.M.Spratt

621.389

8078 ISOTHERMAL BLOOD FLOW VELOCITY PROBE. S.Katsura, R.Weiss, D.Baker and R.F.Rushmer.
I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 283-5 (Dec., 1959).

Two thermistors are mounted close together on a catheter which is inserted in the blood vessel, one forming a heating and the other a sensing element. They are connected as adjacent arms of a Wheatstone bridge and when, through a velocity change, the resistance of the sensing element changes and the bridge becomes unbalanced, the resulting voltage change across the sensing element is amplified, chopped and made to control the voltage applied to the heating thermistor so that balance is restored. The heater voltage, which is a measure of the flow velocity, is continuously recorded. Response time for a flow increase is 0.2 sec; for a decrease, 1.5 sec. The sensing element is compact and inexpensive but absolute calibration is extremely difficult and the frequency response is poor. H.G.M.Spratt

621.389

8079 A NEW VELOCITY PROBE FOR SENSING PULSATILE BLOOD FLOW. A.M Richards and F.W.Kuether.
I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 286 (Dec., 1959).

The probe, which is inserted in the blood vessel, consists of two sensing coils of temperature-sensitive wire with a heating coil between them all three coils being spirally mounted in a mandrel. The sensing coils form two arms of a Wheatstone bridge. Movement of the blood past the heating coils causes the downstream sensor to become warmer than the upstream sensor, the temperature difference varying inversely with flow velocity. The system cuts off at about 50 c/s. Calibrations carried out in glass tubes are reproducible in blood vessels. H.G.M.Spratt

621.389

8080 QUANTITATIVE MEASUREMENT OF BRANCHED FLOW BY EXTERNALLY PLACED RADIOISOTOPE DETECTORS. S.Thompson, G.Sevelius, D.Patrick and P.Johnson.
I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 287-90 (Dec., 1959).

Describes tests carried out on a fluid system, following injection of a radio isotope, to check the validity of the formula which states that, with a branched flow, the ratio of the time-integrated count for the branch to that of the total flow is proportional to the flow through the branch. The system embodies two cylinders A and B and two detectors. In some tests the total flow through A passes subsequently through B and both are viewed by either a common or by separate detectors. In other tests part only of the flow through A passes through B. Good correlation was obtained, indicating that the ratio of the counts was a measure of the relative flow through the branch. Failure to obtain exact correlation was attributed to: (1) the random nature of radioactivity: (2) non-linearity of the rate meter and the recorder; and (3) inaccuracy of the integrating planimeter. H.G.M.Spratt

621.389

8081 CRITICAL REVIEW OF BRISTLE FLOWMETER TECHNIQUES. G.A.Brecher.
I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 294-304 (Dec., 1959).

In this technique, the bristle consists of a needle whose free end dips into a cannulated portion of the vessel from a side tube. The other end is fixed to a diaphragm which is connected mechanically to the anode of a special triode valve forming an electromechanical transducer. Blood flow deflects the free end of the bristle which in turn alters the position of the anode relative to the grid and cathode, so producing an anode–cathode voltage change. With appropriate circuits, which are described, this voltage change can amount to 40V for a 3min. deflection of the bristle. Amongst a number of advantages of the instrument are the following: (1) negligible resistance to flow; (2) equal response to forward and backward flow; (3) small zero drift; and (4) good frequency response.

H.G.M.Spratt

621.389

8082 CERTAIN ASPECTS OF HYDRODYNAMICS AS APPLIED TO THE LIVING CARDIOVASCULAR SYSTEM. D.L.Fry.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 252-9 (Dec., 1959).

A review of the general principles of hydrodynamics is followed by a study of their application to blood flow and, in particular, the feasibility of determining flow velocity from the pressure gradient. The possible effect of the blood cells suspended in the plasma, secondary flow, remote boundary motion and of adjacent boundaries is discussed in great detail.

H.G.M.Spratt

621.389

8083 THE MEASUREMENT OF PULSATILE BLOOD FLOW BY THE COMPUTED PRESSURE GRADIENT TECHNIQUE. D.L.Fry.

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 259-64 (Dec., 1959).

See also preceding abstract. The general relationship between pressure gradient and flow velocity in a cylindrical tube is briefly reviewed followed by a description of rigorous studies of this relationship applied to short rigid tubes. Here a differential pressure transducer was used to determine the pressure differential (dP) over a 15 cm length of the tube. The value obtained was then fed into an analogue computer to solve the differental equation relating dP with the flow (q). The computed value for q was then compared with that obtained from the velocity of the pump piston. From these investigations values were derived for R and L, the fluid "resistance" and "inductance" per unit length respectively. Finally, tests applied to animals and humans, using a double-lumen catheter introduced through an arterial needle puncture, confirmed that the technique, with certain restrictions, is applicable to blood flow measurement.

H.G.M.Spratt

621.389

8084 MEASUREMENT OF CARDIAC OUTPUT IN UNRESTRAINED DOGS BY AN IMPLANTED ELECTROMAGNETIC METER. F.Olmsted

I.R.E. Trans Med. Electronics, Vol. ME-6, No. 4, 210-3 (Dec., 1959).

The sensing unit is a toroidal coil mounted on a nylon sleeve with a lengthwise gap for inserting the aorta. The magnetizing unit is fed from a 400 c/s sinusoidal source. The pick-up electrodes feed via a balanced amplifying system to an oscilloscope. The elimination of inductive and capacitive pick-up presents difficulties and is discussed at length.

H.G.M.Spratt

621.389 : 621.374.32 : 574

8085 TRANSISTOR SWITCH STIMULUS ISOLATOR. H.Fein.

Rev. sci. Instrum., Vol. 31, No. 10, 1070-2 (Oct., 1960).

The instrument described provides rectangular pulses separated from ground by less than 20 pf capacity and essentially infinite resistance. The transistor switch provides pulses at low output impedance, from a floating battery, of 0 to 80 V in amplitude and variable in duration by the width of a triggering stimulus from a conventional stimulator or pulse generator. The device is of particular use in biological experiments where isolation of a stimulating pulse from ground is required.

621.389

8086 THE MEASUREMENT AND SIGNIFICANCE OF BRAIN RHYTHMS. G.K.Nelson.

Trans S. African Inst. Elect. Engrs, Vol. 51, Pt 1, 2-17 (Jan., 1960).

A description is given of the origins of research into the significance of the electroencephalogram. An account of contemporary recording and analysing equipment is followed by a brief statement of the salient findings relating to the psychological meaning of these electrical changes in the brain. An explanation of the need for new methods of display leads to a consideration of toposcopic techniques and finally to a description of the apparatus in use in a modern psychophysiological research laboratory.

621.389 : 534.6

8087 RESULTS FROM THE CONSTRUCTION OF AN ELECTRONIC ULTRASONIC IMAGE CONVERTOR. W.Freitag and H.J.Martin.

Acustica, Vol. 8, No. 4, 197-200 (1958). In German.

Deals with an ultrasonic ionoscope (image convertor) which, because of its electronic mode of operation, operates with a picture frequency of 50 c/s without inertia, ahd has a relatively high sensitivity, making it specially suitable for medico-diagnostic examination.

621.389 : 621.365.5

8088 INDUSTRIAL, BIOLOGICAL AND MEDICAL ASPECTS OF MICROWAVE RADIATION: A.F.Harvey.

Proc. Instn Elect. Engrs, Paper 3315E, publ. Nov., 1960 (Vol. 107B, 557-66).

Reviews the industrial, biological and medical aspects of microwave radiation. The special methods of study of the properties of organic and biological materials are first discussed. The industrial applications of microwave heating processes are described and the effect of microwave radiation on biological tissues and living animals is examined. The operational hazards attaching to personnel in the neighbourhood of high-power equipment are pointed out and suggestions offered as to how these can be minimized.

621.389

INDUSTRIAL, TECHNICAL, AND MEDICAL APPLICATIONS OF INFRARED TECHNIQUES. See Abstr. 8046

TELECOMMUNICATION

621.39

8089 OPTICAL SPACE COMMUNICATION SYSTEMS UTILIZING SOLAR ENERGY. D.D.Erway.
I.R.E. WESCON Convention Record, Vol. 4, Pt 5, 154-61 (1960).

Presents an introduction to optical communication using solar energy as the light source and, in addition, gives the results of some comparative performance studies with r.f. systems. After a discussion of the requirements of the transmitter and receiver, possible designs are considered. Performance limitations are outlined and analysed; emphasis here is placed upon the noise encountered and the characteristics of the sun as a light source. The signal-to-noise equations are examined and plotted for several possible links using realizable parameters. The performance of an r.f. system is then compared to that of a solar–optical system for a specific link. The results are presented as the required transmitted r.f. power to give the same information rate as a solar–optical system. For this comparison, equivalent aerial areas are assumed for both systems.

621.391

8090 FILTERING OPERATIONS USING COHERENT OPTICS. L.J.Cutrona, E.N.Leith and L.J.Porcello.
Proc. Nat. Electronics Conf., Vol. 15, 262-75 (1959).

Coherent optical systems have the inherent property that a Fourier transform relation exists between the light-amplitude distributions at the front and back focal planes of a lens used in such a system. An optical system which alternately presents space-domain functions and successive Fourier transforms is easily implemented. As a result, operations of an integral transform nature are carried out, in an optical system, in a manner often more convenient than would be the case using an electronic channel. Illustrative examples are presented, along with the results of some experiments of interests to the communications engineer. Throughout the treatment, the two-dimensional nature of an optical channel is exploited in such a manner as to provide either a true two-dimensional processor or a multi-channel filter bank.

621.391

8091 PROPAGATION OF ELECTRIC WAVES IN SPACE AND ALONG CONDUCTORS. L.Leng.
Brown Boveri Rev. Vol. 46, No. 11-12, 644-55 (Nov.-Dec., 1959).

This is a discussion of various means of communications presently in use. A.E.Karbowiak

621.391

8092 CODE RINGS AS A METHOD OF REPRESENTING CODE SETS. A.N.Radchenko.
Avtomat. i Telemekh., Vol. 20, No. 7, 970-7 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 7, 945-51 (July, 1959; publ. March, 1960).

A method is considered for the shortening of the writing of sets of code combinations by excluding from the constituents of various codes the repeated combinations of terms of less than the full (maximum) length. An analysis is made of the conditions for the existence of such shortened forms of representing code sets, called code rings, and the existence of various types of code rings is proved. The shortened from of writing code combinations may be used for decreasing the number of circuit elements or for increasing the capacity of a given number of elements.

621.391 : 621.372.6 : 518.5

8093 PRECISION INTEGRATOR NETWORKS FOR SLOWLY GROWING PROCESSES. G.Bonnet.
J. Phys. Radium, Vol. 19, Suppl. No. 12, 140A-143A (Dec., 1960). In French.

The study of the behaviour of passive electric networks intended to assure the integration of a signal with the minimum of error shows that the quality of this behaviour can be deduced from the asymptotic expansion of this transfer function. It is possible to obtain from it the value of the error of integration in a simple analytic form. An example of an integrator network equipped with compensation was developed, and the comparison of its characteristics with those of the network usually used shows that one can obtain from it, with the same conditions of error, a much less important weakening of transmission which allows it to be used for longer periods.

621.391 : 621.372.54

8094 NARROW-BAND FILTERING OF RANDOM SIGNALS. S.P.Lloyd.
Proc. Inst. Radio Engrs. Vol. 48, No. 6(I), 1167 (June, 1960).

There is a misconception that the output of a narrow-band filter is more nearly Gaussian than some corresponding non-Gaussian random input. It is suggested that in some of the heuristic arguments usually given small correlation is confused with small stochastic dependence. Two examples are given in which the output is in fact less Gaussian than the input. It is admitted that the proof given relates to non-ergodic processes and that the usual statements may be true for a stationary process which is ergodic in the wide sense. S.C.Dunn

621.391

8095 THE POSSIBILITY OF OBTAINING INDEPENDENT SAMPLES FROM STATIONARY GAUSSIAN SIGNALS. M.Frankfort.
Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1491-2 (Aug., 1960).

It is shown that any random signal from which statistically independent samples can be drawn has a power spectrum satisfying a certain integral equation. Examples are given to show that the existence of statistically independent samples in a random signal is neither required nor insured by its having a power spectrum which is identically zero outside a finite frequency band. S.C.Dunn

621.391

8096 AN ELECTRONIC DEVICE TO MEASURE THE INTELLIGIBILITY OF SPEECH. J.C.R.Licklider, A.Bisberg and H.Schwarzlander.
Proc. Nat. Electronics Conf., Vol. 15, 329-34 (1959).

The method of approach is presented for the instrumentation of an electronic device to measure the intelligibility of speech. Results of measurements and methods of application are discussed.

621.391

8097 INFORMATION CAPACITY OF COMMUNICATION NETWORKS. L.S.Schwartz.
Proc. Nat. Electronics Conf., Vol. 15, 414-20 (1959).

When circuits are put together to form communication networks of transmitters and receivers, as in air-defence and missile systems, performance is measured in terms of parameters like transformation flow and error probability. It is demonstrated that, as in the case of electrical circuits, topology can be a useful tool in establishing fundamental properties of communication networks. Information flow is treated as the analogue of branch current. The information capacity of the network may be obtained from the minimum-valued cut-set theorem, knowing the branch capacities. By this means changes in overall network capacity with changes in circuit configuration or branch capacity may be determined.

621.391

8098 OPTIMUM LINEAR LEAST-SQUARE SMOOTHING AND PREDICTION. R.Mittra.
Proc. Nat. Electronics Conf., Vol. 15, 422-30 (1959).

Discusses the mathematical problem of the design of smoothing and prediction filters for stationary random processes. The integral equation associated with the problem is

$$\eta(t) = \int_0^T W(\tau)\,\varphi(t-\tau)d\tau.$$

Methods for solving this equation when $\eta(t)$ and $\varphi(t)$ are given and

$$\varphi(t) = \Sigma C_n e^{-\gamma_n|t|}$$

are presented. The two cases of finite and infinite sampling time $T^{[1]}$ are discussed separately.

621.391

8099 TRANSFORM–ENSEMBLE METHOD FOR ANALYSIS OF LINEAR AND NONLINEAR SYSTEMS WITH RANDOM INPUTS. Y.H.Ku and A.A.Wolf.
Proc. Nat. Electronics Conf., Vol. 15, 441-55 (1959).

Presents a general transform–ensemble method for a systematic analysis of physical systems with random inputs. The concept of the transform of an ensemble average is introduced. It is shown

that for a certain class of linear and nonlinear systems with continuous random response there exists a corresponding class of linear and nonlinear random-walk problems. It is shown that it is possible with the proper transform to map a random process in one domain into a simpler random process in another domain to permit an easier solution of the problem. It is now possible to obtain solutions of stationary random processes and corresponding solutions of non-stationary random processes. The philosophy and proof of the transform of statistical quantities is given as a theorem and illustrated with a number of examples.

621.391

8100 COLLATION AND COMPARISON OF KNOWN METHODS FOR DETECTING A PERIODIC PULSE IN THE PRESENCE OF NOISE. D.Hausig.
Hochfrequenztech. u. ElektAkust., Vol. 69, No. 3, 94-103 (June, 1960). In German.

It is shown that all methods of signal–noise ratio improvement depend on the difference between correlation processes with coherent and incoherent quantities. Two methods are described in detail, one using an optimum filter, the other using storage. It is shown that methods using integration are superior to those using short-time cross-correlation. S.C.Dunn

621.391 : 621.372.54

8101 PREDICTION OF STATIONARY RANDOM SIGNALS. J.Gecsei.
Slaboproudy Obzor, Vol. 21, No. 5, 293-9 (1960). In Czech.

A signal $g(t) = s(t) + n(t)$, where $s(t)$ is the useful signal and $n(t)$ is noise, is applied to the input of a linear filter. Both $s(t)$ and $n(t)$ are assumed to be stationary random processes. It is necessary to determine the transfer function $D(j\omega)$ of the filter in such a way as to obtain the minimum s./n. ratio at its output and the best prediction of $s(t)$ at the instant $(t + d)$. It is shown that these requirements are met by:

$$D(j\omega) = \frac{S_s}{S_s + S_n} \exp(j\alpha\omega)$$

where S_s and S_n are the power spectral densities of $s(t)$ and $n(t)$, respectively. The synthesis of the filter on the basis of S_s and S_n is explained and the procedure is illustrated by two numerical examples R.S.Sidorowicz

621.391

8102 POSSIBILITIES OF INCREASING NOISE STABILITY BASED ON THE USE OF A PRIORI PARAMETER PROBABILITIES. V.A.Kashirin and G.A.Shastova.
Avtomat. i Telemekh.,Vol. 20, No. 9, 1239-49 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 9, 1208-18 (Sept. 1959; publ. May, 1960).

The noise stability of an ideal receiver is considered, the first distribution law of the "a priori" parameter value probabilities taken into account. An analysis of noise stability is carried out for the case of a nonlinear parameter transformation prior to modulation. The optimal nonlinear transformation of parameters prior to transmission is found, as well as the gain in noise stability obtained with this transformation. Both the mean square and the information criteria of optimality are used.

621.391

8103 QUESTIONS OF POTENTIAL NOISE STABILITY WITH FADING SIGNALS. D.D.Klovskii.
Radiotekhnika, Vol. 15, No. 5, 17-25 (May, 1960). In Russian.

Criteria are derived for the reception of both coherent and incoherent signals on an ideal receiver when the information is in discrete form and competing with fluctuation noise and is rapidly fading. The probability density distribution of the signal is assumed to be Rayleigh. A circuit is shown which could be used for receiving a signal according to the criteria derived. For certain classes of systems the least probable error in reception is also calculated. S.C.Dunn

621.391

8104 FIRST AND SECOND ORDER DISTRIBUTIONS OF A SINE WAVE OF RANDOM PHASE PLUS GAUSSIAN NOISE. R.Leipnik.
Z. angew. Math. Phys., Vol. 11, No. 2, 117-26 (March 25, 1960).

By means of a Fourier conversion of a formula by Rice, [Abstr. 1385 of 1946 and Bell Syst. tech. J., Vol. 27, 109-57 (1948)] an explicit formula for the first and second-order distribution of a sine wave of fixed amplitude and uniformly distributed random phase plus Gaussian random noise is derived in terms of Bessel series multiplied by Gaussian distributions.

621.391 : 621.372.54

FILTERING BY MEANS OF TIME-VARYING R(t)C CIRCUITS.
See Abstr. 7648

TELEGRAPH AND TELEPHONE SYSTEMS

621.394.1

8105 IMPROVEMENT OF THE SIGNAL TO NOISE RATIO BY SEQUENTIAL MULTIPLICATION OF TIME-DISPLACED SIGNAL VOLTAGES. A.Ginzburg.
Latv. PSR Zinat. Akad. Vestis, No. 3 (152), 65-70 (1960). In Russian.

Analyses theoretically a circuit in which the input signal f_c passes to two channels. The first channel consists of a mixer C_1, local oscillator (f_g), i.f. filter ($f_c + f_g$), time-displacement circuit and second mixer C_2. The input signal passes directly via the second channel to C_2. A second filter following C_2 separates f_g which passes, firstly via a delay circuit Z_2 to a third mixer C_3, and secondly direct to C_3. A final integrator circuit follows C_3. Double multiplication of time-displaced signals mixed with noise increases the over-all coefficient of detectability by 25% as compared with similar single multiplication, and triple multiplication by 35%. D.E.Brown

621.394.3

8106 A COMPARISON BETWEEN ALTERNATIVE H.F. TELEGRAPH SYSTEMS. J.V.Beard and A.J.Wheeldon.
Point to Point Telecomm., Vol. 4, No. 3, 20-47 (June, 1960).

The concept of an "ideal detector" is employed in order to establish a basis for comparison between alternative h.f. telegraph systems. An "ideal detector" is one which would give the lowest error rate theoretically possible for any given signal-to-noise ratio. The discussion is in fair detail and one of the conclusions drawn is that the two-tone system in multichannel telegraphy gives the best performance by a substantial margin. H.L.Nattrass

621.394.324

8107 A NON-SYNCHRONOUS APPROACH FOR IMPROVED COMMUNICATIONS RELIABILITY.
C.H.Stewart, II and C.E.Baker, Jr.
Proc. Nat. Electronics Conf., Vol. 15, 141-50 (1959).

The record postwar use of communications has created an ever expanding requirement for mobile teleprinter communications. The circuit quality which is readily attainable for this communication service would be considered as marginal for other classes of service, such that the use of conventional techniques will not yield the required circuit reliability. One approach to the provision of increased performance reliability is the transmission of a minimum of information for each character definition so as to minimize detector bandwidth. By using sequential combinations of two audio-frequency tones to define the combinatorial possibilities of the standard five-bit teleprinter code, the per-tone sampling period is increased by a factor in excess of three times that of the start-stop system. The nonsynchronous characteristic of this coding scheme allows optimum use of a variable band-width, so that the system can be operated at the maximum circuit capacity for all conditions. A system has been developed utilizing these techniques. The results of both laboratory tests and operational use appear to verify the predicted reliability of overall performance.

621.394.34

8108 THE AUTOMATIC TELEX SERVICE.
A.E.T.Forster, R.W.Barton and W.A.Ellis.
Pap. Instn. Post Off. Elect. Engrs, No. 216, 30 pp, (June, 1960).

Describes the final conversion to full automatic working with subscriber dialling facilities for all inland (Great Britain) and most international calls. The system is based on the use of the 2000 type selector with dial selection based on a linked numbering scheme and fifty charging areas with time and zone metering. The aspects of the system considered in some detail include trunking principles, transmission and signalling, subscribers' station

equipment and facilities, miscellaneous services, exchange equipment and facilities including metering and routing translation. maintenance, service observation, and international traffic.

W.J.Mitchell

621.394.441

8109 **A TRANSISTORIZED V.F. TELEGRAPH SYSTEM.** D.J.Simmons, P.N.Clarkson and L.G.Farnham.

T.M.C. tech. J., Vol. 8, No. 4, 165–80 (July, 1960).

A fully transistorised 18-channel f.m. system, operating 50-baud over a 4-wire speech circuit between line frequencies of 170 and 3230 c/s. Channel mid-band frequencies are odd multiples of 85 c/s and there are two groups of which the primary group lies in the band 1785–3145 c/s. The secondary group is derived from the primary group by group modulation at 3400 c/s, the lower s.b. being selected. Oscillator frequency stability is ±1% for temperatures from 0–50°C, and output stability is ±0.5 dB for the same range. Characteristic distortion is <3% at 20°C for 50 bauds, rising to 6% at 75 bauds. Maximum transmit level, 4-wire, is −12 dBm, and 2-wire is −10 dBm. The equipment is based T.M.C. Unit Construction Practice, and a fully equipped system of 18 duplex channels occupies an 8 ft 8 in. (2.64 m) single-sided rack.

W.J.Mitchell

621.395.12 : 621.391.826.6

8110 **TELEPHONE ECHO TESTS.** D.L.Richards and G.A.Buck.

Proc. Instn Elect. Engrs, Paper 3338 E, publ. Nov., 1960 (Vol. 107 B, 553–6).

Electrical reflection on telephone circuits having appreciable times of propagation can cause delayed sidetone effects subjectively similar to echo. The variations in subjects' tolerance of this echo is examined experimentally as a function of echo attenuation and delay. The dispersion of tolerance between subjects is also considered, and this yields information in a form suitable for planning telephone networks so that echo will not cause excessive inconvenience.

621.395.124

8111 **ANNOYANCE HOLD INTERCEPTION EQUIPMENT.** L.W.Wheatcroft.

G.E.C. Telecomm., No. 30, 25–8 (July, 1960).

The provision normally of "calling-party-release" in Strowger switching systems renders the identification of the calling line in a "nuisance" call extremely difficult, but the provision generally of "called-party release" is neither practical in an established system nor economic. The equipment described is an annoyance-hold relay set which can be used at both main and satellite exchanges, and which is connected into a subscriber's line by means of cords and plugs on the m.d.f. or by jumpers on the i.d.f., and provides the last party release facility for annoyance interception subscribers only. Among a list of ten main features given are: (a) the subscriber controls the release of all local calls (incoming or outgoing); (b) the subscriber when called can gain access to an operator by dialling "O"; (c) the operator can talk to the annoyed subscriber privately; (d) the annoyed subscriber can be released from the connection to make fresh calls while the calling line is traced; (e) normal secrecy of calls is not affected. The various circuit arrangements involved are illustrated and described.

W.J.Mitchell

621.395.24

8112 **2 + 5 EXCHANGE-CONNECTED INTERCOM SYSTEM.** A.C.McDowall.

A.T.E.J., Vol. 16, No. 1-3, 77–85 (Jan.-July, 1960).

The system described has been developed to provide access from any one of five telephone stations to either of two exchange lines, with facilities for intercommunication between the stations. The switching requirements for a system of this kind are defined and it is shown that this system meets these requirements. The system is described and the general principles of both exchange and intercom. operation are outlined with details of the priority and secrecy facilities that are available. Examples of connection of the system for various applications are illustrated and a brief description of the circuit is given.

621.395.34

8113 **A UNIT TRUNK AUTOMATIC EXCHANGE.** J.A.Scowcroft.

A.T.E. J., Vol. 16, No. 1-3, 1–12 (Jan.-July, 1960).

Describes an automatic trunk switching centre designed specifically to meet the needs of telephone networks employing radio, carrier or physical circuits. The trunk automatic exchange (t.a.x.) described caters for up to 50 bothway junctions, with provision for 4-wire switching and impulse regeneration. It is suitable for use in both public and private exchange networks. Aspects of line and radio coordination are discussed, including tandem working, the application of the marker control principle, transmission loss and impulse distortion. A brief description is given of the equipment and its general operation.

621.395.34

8114 **T.M.C. DIAL CONCENTRATORS.** S.Chapman and R.A.Stubbings.

T.M.C. tech. J., Vol. 8, No. 4, 181–94 (July, 1960).

These are rural automatic exchanges developed for the N.American market for small community use, where the multiparty line tends to be common. A crossbar bridge is used as the switching element and the exchange is made in two sizes, having ultimate capacities of 10 and 20 lines with provision for 4 and 6 simultaneous conversations respectively. All the subscriber line circuits can be used as single-party, multiparty or pay-station lines, the multiparty lines serving up to ten subscribers. The ringing facilities include a B.P.O. 3000 type ringing vibrator operating from the common power supply, providing 80 V at 17-20 c/s, the harmonics being used for dial and ringing tones, busy tone (400 c/s) being produced by a separate transistor oscillator. Coded ringing is also provided, having an 8 sec cycle. Normal or revertive subscriber-to-subscriber calls, junction calls, and semi-post-payment station operation are provided. Circuit features are illustrated and described.

W.J.Mitchell

621.395.341.5

8115 **THE DIRECT-LINE EMERGENCY REPORTING SYSTEM.** F.M.Pearsall, Jr.

Bell Lab. Record, Vol. 38, No. 7, 256–61 (July, 1960).

A direct-line reporting system consisting of telephone sets (570-type) mounted in metal, weather-proof boxes conspicuously marked and located and individually connected to emergency headquarters. Each circuit terminates in both jack and key appearances at a PBX switchboard, and numerous safeguards are built-in to the equipment. Once the attendant answers (by key-depression or by plug-in-jack) the call is held until dealt with. Each line terminates at two positions in the switchboard, but can be put under the control of one attendant. Each line also is normally permanently monitored for faults or failures (natural or by vandalism), and is protected against "surge" operation. Provision is also made for separate headquarters for police reporting and emergency reporting, the former being under the control of a police officer who wishes to make a report. Calls may also be recorded by tape-recording the conversation with a calling party or by page-printing the line identity, the date and the time. A photograph of a reception position, and pictorial representations of the principal circuits in operation are included.

W.J.Mitchell

621.395.341.72

8116 **A WIRED-MEMORY TRANSLATOR WITH SHARED ACCESS.** F.P.Pace and B.Ostendorf, Jr.

Trans Amer. Inst. Elect. Engrs I, Vol. 79, 216–20 (1960) • Commun. and Electronics, No. 49 (July, 1960).

Describes a flexible translator of large capacity, with a non-volatile memory, and for operation at speeds compatible with present-day automatic telephone and telegraph switching systems, with particular reference to the conversion of mnemonic addresses and group addresses into route indicators for use by a data-switching system. Addresses are accepted which consist of from two to eight alphabetical characters of five bits per character, and relays convert each character into a one-out-of-32 selection for each of the eight (maximum) alphabets represented by the eight translators. Up to 2000 addresses are accommodated, and 2000 code "and" gates with 8 input leads each are provided, the appropriate one corresponding to a particular selection of 8 conditions from the translator, responding to give an output pulse to a transistor output ring circuit and operate an output relay. A sequence scanner provides for orderly access to the translator from up to 50 machines, both at the input and the output, and the holding time per translation is 53 milliseconds. By careful overlapping of successive requests, this is reduced to an effective value of only 37 milliseconds. A timing chart illustrates this. A 4-unit parity check counter is provided, together with monitoring and testing facilities.

W.J.Mitchell

621.395.345

8117 THREE-HOLE CORES FOR COINCIDENT-FLUX MEMORY. H.F.Priebe, Jr.

Electronics, Vol. 33, No. 31, 94-7 (July 29, 1960).

Describes briefly the characteristics of three-hole cores and their use in high-speed coincident-flux memories for telephone switching. The organisation of a destructive read memory with a 3.15 μs cycle time is detailed. The 1120 bit memory has 40 rows of 28 bits which may be scanned sequentially in 125 μs. Operation is achieved over wide temperature range and pulse current amplitude. Circuit diagrams of the transistor pulse amplifiers are given. D.J.Truslove

621.395.345

8118 THE CAPACITIVE SEMI-PERMANENT INFORMATION STORE AND ITS USES IN TELEPHONE EXCHANGES. J. Van Goethem.

Proc. Instn Elect. Engrs, Paper 3367 E, publ. Nov., 1960, 7 pp. [Conference on Electronic Telephone Exchanges]. To be republished on Vol. 108 B (1961).

A new device is described for storing semi-permanent information, making use of patterns of capacitive couplings at the cross-points between rows and columns of a matrix arrangement. These patterns may easily be changed manually according to the information to be stored. Printed wiring techniques are used throughout, including the capacitive cross-point elements. Basically the new device acts as a code translator, and accordingly it has a wide field of application as a library information store in any data processing systems. Specific examples are given of its adaptability in electronic telephone switching systems, with the object of greatly extending their facilities and generally increasing their flexibility.

621.395.345

8119 HIGHGATE WOOD ELECTRONIC TELEPHONE EXCHANGE: FACILITIES AND PROBLEMS OF COMPATIBILITY. C.A May.

Proc. Instn Elect. Engrs, Paper 3374 E, publ. Nov., 1960, 8 pp. [Conference on Electronic Telephone Exchanges]. To be republished in Vol. 108 B (1961).

The problems involved in introducing a new type of exchange into an existing telephone network are discussed. Some of the lesser-known facilities given by a modern automatic exchange are described and reference is made to how they will be provided at Highgate Wood.

621.395.345

8120 RELIABILITY AND MAINTENANCE OF ELECTRONIC EXCHANGES. W.T.Duedoth and J.A.Lawrence.

Proc. Instn Elect. Engrs, Paper 3375 E [Conference on Electronic Telephone Exchanges], publ. Nov., 1960, 8 pp. To be republished in Vol. 108 B (1961).

A review is made of the basic requirements relating to reliability of telephone exchanges. The terms "quality" and "continuity of service" are introduced as criteria for expressing the reliability quantitatively. Adequate reliability must be obtained despite the existence of faulty components and the system must be designed to be fault tolerant. It is estimated that a component failure rate not exceeding 0.05% per annum is necessary. The system can be made fault tolerant by using a multiplicity of similar transmission paths and functional sections. This multiplicity can either be in the form of redundant equipment or may consist of several alternative paths and sections continuously in use. Examples of redundancy techniques to be used in the Highgate Wood exchange are given. A brief analysis of the relative merits of various methods of obtaining fault tolerance and their relation to the permissible repair time is made.

621.395.345

8121 THE HIGHGATE WOOD EXPERIMENTAL ELECTRONIC TELEPHONE EXCHANGE SYSTEM. L.R.F.Harris, V.E.Mann and P.W.Ward.

Proc. Instn Elect. Engrs, Paper 3376 E, publ. Nov., 1960, 11 pp. [Conference on Electronic Telephone Exchanges]. To be republished in Vol. 108B (1961).

An experimental public service telephone exchange is to be installed at Highgate Wood in North London. It has been developed in order to gain experience of the problems posed by introducing electronic exchanges into the public network. It meets a full and flexible facility schedule, and will test a variety of electronic time-sharing and common-control techniques in the field. Speech and other signals are transmitted over unidirectional highways carrying 100 time-division-multiplex pulse channels. Each connection uses a pair of antiphase channels and is set up through line and inter-highway switches by storing channel pulses in magnetostriction delay lines. Delay lines also form the central feature of common register and supervisory equipments which, by operating with the channel pulses, control the setting up and progress of all calls. Common apparatus selects the channels to be used on all connections which are set up one at a time using information stored on magnetic-drum tracks. Such information includes the directory number, meter record, state, class of service and type of each line, together with a library of translations required to route calls over junctions. A diversity of circuit techniques is included in the Highgate Wood exchange, which also incorporates security arrangements and maintenance problems. The experience gained during the design, development, manufacture and trials of the system is expected to prove invaluable in progressing towards the telephone system of the future.

621.395.345 : 621.382.2

8122 THE P-N-P-N DIODE AS A CROSS-POINT FOR ELECTRONIC TELEPHONE EXCHANGES. J.E.Flood and W.B.Deller.

Proc. Instn Elect. Engrs, Paper 3377 E, publ. Nov., 1960, 12 pp. [Conference on Electronic Telephone Exchanges]. To be republished in Vol. 108B (1961).

A telephone exchange built on a basis of spatial switching of the speech paths uses a large number of cross-points, the nature of which is therefore a vital factor in the final assessment of a spatial switching system. Discusses the use of a semiconductor diode as a cross-point. A p-n-p-n diode has a high "off" impedance and a low "on" impedance. It is triggered from its "off" to its "on" state by applying a large voltage across it, and is maintained in its "on" state by passing a maintaining current through it. The germanium p-n-p-n diode has a lower forward voltage drop in the "on" state than has the silicon diode, but has a lower "off" impedance and is more sensitive to temperature variations. A description is given of the way in which a speech connection through a single switching stage is set up using coincident voltage pulses. This method can be developed to allow the connection of tandem switching stages. Unbalanced switching is used, a transformer in the subscriber's line circuit converting from 2-wire to a single-wire speech path, with earth return. Voltage and current clamps are used to prevent excessive current surges switching off the cross-points. The overall insertion loss of the network is low, and the contribution of the cross-points to this loss is negligible. The reduction in size of the switching network that the p-n-p-n cross-point allows reduces the crosstalk problem of unbalanced switching although it does not eliminate it.

621.395.345

8123 AN EXPERIMENTAL SPACE-DIVISION TELEPHONE EXCHANGE. A.Heetman.

Proc. Instn Elect. Engrs, Paper 3381 E, publ. Nov., 1960, 11 pp. [Conference on Electronic Telephone Exchanges.]. To be republished in Vol. 108 B (1961).

A description is given of an electronic telephone exchange employing p-n-p transistors as switching elements at the cross-points of a space-division system, and the method whereby this type of p-n-p-n network is controlled for setting up a connection is explained. The paper concludes with a short description of the control equipment used, such as the information distributor, the marker, the number translator, the central register and inventory memories.

621.395.345

8124 THE MORRIS ELECTRONIC TELEPHONE EXCHANGE. W.Keister, R.W.Ketchledge and C.A.Lovell.

Proc. Instn Elect. Engrs, Paper 3382 E, publ. Nov., 1960, 7 pp. [Conference on Electronic Telephone Exchanges]. To be republished in Vol. 108B (1961).

The Morris electronic exchange is providing dial telephone service in Morris, Illinois, U.S.A. It is an experimental installation which will serve about 600 customers during the trial period. The remaining customers in Morris are served by a No. 5 crossbar unit. In the electronic system, calls are switched through a space separation network using gas-filled diodes as cross-points. All control actions are performed by a central control unit consisting of transistor and diode logic circuits. Memory functions are

centralized in a barrier-grid store unit for temporary memory and in a flying-spot store photographic memory unit for semi-permanent memory. The system is controlled by a programme of instructions stored in the semi-permanent memory. Major units are duplicated for reliability. Automatic trouble detection, trouble recording and trouble location features are provided. The system appears to offer two basic advantages which make important technical and economic gains possible. The first is the speed of electronic circuits, which allows centralization of basic functions and sharing of services of a given equipment unit. The second is stored programme control, which allows great flexibility in meeting the problems of growth, new services and changing requirements.

621.395.345 : 621.374.32

8125 SUPERVISORY EQUIPMENT FOR A T.D.M. ELECTRONIC TELEPHONE EXCHANGE.

A D Martin.
Proc Instn Elect. Engrs, Paper 3383 E, publ. Nov., 1960, 7 pp [Conference on Electronic Telephone Exchanges.]. To be republished in Vol. 198B (1961).

The need for continuous supervision of all telephone calls, whether successful or not, is explained. The mode of operation of the common supervisory equipment used in the Highgate Wood electronic telephone exchange is described in relation to a simple successful local call.

621.395.345

8126 REGISTER EQUIPMENT FOR A TIME-DIVISION-MULTIPLEX ELECTRONIC TELEPHONE EXCHANGE.

J.E.Flood and B.D.Simmons.
Proc. Instn Elect. Engrs, Paper 3386 E, publ. Nov., 1960, 9 pp. [Conference on Electronic Telephone Exchahges.]. To be republished in Vol. 1u8 B (1961).

Register equipment has been designed for use in a time-division-multiplex electronic telephone exchange. Calls using the register do so by means of trains of pulses occurring at different times in a cycle but on a single common high-way. Information is therefore stored and processed using the same pulse positions. Storage and logical gating circuits are thus time-shared among all calls being set up at any period. The stores comprise magnetostrictive delay lines and the logical circuits use diode-resistor gates and transistor buffer amplifiers. The operations performed by the register equipments for setting up various types of call are described in detail. The method used for providing continuity of service under fault conditions is explained and the mechanical design of the equipment is described. The provision of registers for exchanges of different sizes is also discussed.

621.395.345 : 621.376.5

8127 SPEECH AND SIGNALLING SWITCHING EQUIPMENT IN THE HIGHGATE WOOD ELECTRONIC TELEPHONE EXCHANGE.

C.G.Crossley, W.T.Duerdoth, J.A.T.French and R.F.Rous.
Proc. Instn Elect. Engrs, Paper 3393 E, publ. Nov., 1960, 12 pp. [Conference on Electronic Telephone Exchanges]. To be republished in Vol. 108B (1961).

Gives details of the common time-shared paths used for the switching of speech connections, the transmission of tones and the transmission and detection of line signals for a 3200-line electronic exchange to meet the facility requirements for public service. The exchange will work with the existing telephone and bell and existing junction signals. Exchange lines of all types terminate on individual line equipments which are arranged in 800-line groups and provide access to the common 4-wire time-shared paths. Compatible time-division-multiplex pulse techniques using 100 pulse channels per group are employed for the speech and signal paths and for the common control equipment. The speech-path pulses are voltage amplitude modulated by the speech signals. Details are given of the diode gates and amplified coaxial cable links used in the common speech paths, and the means of meeting transmission performance requirements, particularly with regard to crosstalk and gain stability. Crosstalk attenuation is limited by energy storage in switching diodes diodes, highways, and paths interconnecting the main switching stages. Proposals are given for future developments aimed at reducing the size and power consumption and improving the reliability of the equipment.

621.395.345

8128 PROGRAMME-CONTROLLED LOGICAL SYSTEMS IN ELECTRONIC TELEPHONE EXCHANGES.

H.H.Adelaar and A.Salle.
Proc. Instn Elect. Engrs, Paper 3390 E, publ. Nov., 1960, 10 pp. [Conference on Electronic Telephone Exchanges]. To be republished in Vol. 108 B (1960).

Stored programmes are currently used for controlling logic operation in computer, industrial control and data-processing systems. The use of this technique in the common control of electronic telephone exchanges has been described by Joel (Abstr. 489 of 1959) and others. In order to derive maximum profit from this concept, which appears to be new in the telephone switching art, its implications must be clearly understood and its essential features must be defined in the most general terms. As an approach to this end, the first part of the paper describes the necessary elements of a programme-controlled logical system for use in common control of an electronic telephone switching exchange. Some principles of logical operation are given, which may be considered for application. In the second part a specific example is described in more detail.

621.395.345 : 621.374.32

8129 PRINCIPLES OF CONNECTION CONTROL IN AN ELECTRONIC TELEPHONE EXCHANGE BY THE USE OF MAGNETIC DRUMS. R.G.Knight and V.E.Mann.
Proc. Instn Elect. Engrs, Paper 3394 E, publ. Nov., 1960, 3 pp. [Conference on Electronic Telephone Exchanges]. To be republished in Vol. 108B (1961).

Describes some functions of storage within a telephone exchange, and, in particular, the application of a magnetic drum to this storage in an electronically controlled time-division-multiplex telephone exchange. It serves as an introduction to supporting papers relating to the methods of application within a particular exchange system. There is discussion of the methods of use of the drum and of the types of circuits employed with it in the logical manipulation of the stored information.

621.395.345

8130 EXCHANGE CODE TRANSLATION IN A MAGNETIC-DRUM-CONTROLLED ELECTRONIC TELEPHONE EXCHANGE. R.D.Allum and D.G.Bryan.
Proc. Instn Elect. Engrs, Paper 3396 E, publ. Nov., 1960, 3 pp. [Conference on Electronic Telephone Exchanges]. To be republished in Vol. 108B (1961).

In an electronic telephone exchange to be installed shortly at Highgate Wood a magnetic drum is used to store information relating to the routing of calls through the exchange and the external network. Exchange codes are translated into the appropriate routing instructions by reference to the drum store.

621.395.345 : 621.374.32

8131 TERMINATING CALL CONNECTIONS IN A MAGNETIC-DRUM-CONTROLLED ELECTRONIC TELEPHONE EXCHANGE. R.G.Knight and R.D.Allum.
Proc. Instn Elect. Engrs, Paper 3397 E, publ. Nov., 1960. 3 pp. [Conference on Electronic Telephone Exchanges]. To be republished in Vol. 108 B (1961).

In an electronic telephone exchange shortly to be installed at Highgate Wood and using a time-division-multiplex principle, a magnetic drum is used to search for semi-permanent information stored on the drum relating to called subscribers' lines. A temporary store associated with each line is used to determine whether a connection is possible and if so, information relating to the line is passed to other sections of the exchange, so that a connection can be established between the calling and called lines.

621.395.345

8132 A FULLY ELECTRONIC PRIVATE AUTOMATIC TELEPHONE SWITCHBOARD. J.G.Van Bosse.
Proc. Nat. Electronics Conf., Vol. 15, 585-92 (1959).

Describes a fully electronic solid-state automatic telephone switchboard designed to serve as a private automatic exchange for up to 100 subscribers. Voice-frequency connections between subscribers are made in a four-stage switching network, using p-n-p-n-silicon diodes as switching elements. Control actions in the system are performed by centralized equipment which is time-shared by all subscribers.

621.395.345

8133 A 240-LINE FULLY ELECTRONIC TELEPHONE SWITCHBOARD. G.Goudet.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 232-41 (1960) = Commun. and Electronics, No. 49 (July, 1960).

Three possible systems for the speech circuit of a telephone switchboard, semielectric, space-division electronic and time-division electronic are discussed briefly, followed by a more detailed discussion of the 240-line p.a.b.x. This outlines the complete process set in motion when a new line is identified as calling and describes various constitutive parts such as busy-line, busy-junction and call status memory, register, line scanner and priority distributor circuits, including several circuit block diagrams. Finally some descriptive and numerical data of the complete system are given. M.Goldberg

621.395.354 : 681.142

8134 SUBSCRIBER'S METER RECORDING IN AN ELECTRONIC TELEPHONE EXCHANGE.
R.G.Knight and N.C.Hunter.
Proc. Instn Elect. Engrs, Paper 3398 E, publ. Nov., 1960, 6 pp. [Conference on Electronic Telephone Exchanges]. To be republished in Vol. 108B (1961).

Describes a method of meter recording within an electronic t.d.m. telephone exchange in which a magnetic drum is the basic storage medium. The meter records consist of the total number of unit fees that have accrued to each line on the exchange. Shared lines have a separate meter record for each party. Under present conditions, a unit fee corresponds to one local call; these calls are not timed. With subscriber trunk dialling, all calls will be timed, and the number of unit fees recorded for each call will depend on the distance of the call and its duration. Meter records are stored on the magnetic drum. Addition to a meter record on the drum is carried out under the control of meter pulses received from the supervisory equipment; each meter pulse represents a unit fee. Provision has been made for meter records to be read out at a meter record centre (m.r.c.), remote from the exchange. Selection of the meter records to be read out, and the time at which this takes place is made at the m.r.c. When the meter records are read out, printed copies and/or punched tapes suitable for feeding into a general-purpose computer are produced at the m.r.c.

621.395.435 : 621.382.2

8135 ESSEX-A CONTINUING RESEARCH EXPERIMENT IN TIME-SEPARATION COMMUNICATION.
D.B.James and H.E.Vaughan.
Proc. Instn Elect. Engrs, Paper 3387 E, publ. Nov., 1960, 6 pp. [Conference on Electronic Telephone Exchanges]. To be republished in Vol. 108 B (1961).

A brief history of the research programme in electronic switching outlines the events which led to "Essex" (experimental solid-state exchange), a time-separation communication system experiment. The organization of the laboratory system, which combines remote line concentration, time-separation switching, and p.c.m. transmission, all implemented by solid-state devices, is reviewed. Variations in organization which provide greater flexibility are discussed. Facilities for conventional ringing and dialling have been added to the laboratory model. New solid-state circuits which use fewer components and less power and a new encoder with a built-in compression characteristic have been tested in the model. These recent changes are described.

621.395.345

8136 SPACE-DIVISION ELECTRONIC TELEPHONE EXCHANGES. F.H.Bray and L.J.Murray.
Proc. Instn Elect. Engrs, Paper 3413 E, publ. Nov., 1960, 9 pp. [Conference on Electronic Telephone Exchanges]. To be republished in Vol. 108 B (1961).

Cross-points used in a space-division switching system must fulfil certain requirements in regard to transmission, signalling, control and economics. Several types of component have been proposed for this function and the paper discusses them in the light of these requirements. A description is given of the trunking and control of a space-division switching network through which calls can be set up on a one-at-a-time basis. The cross-points used in such a system can be any of the types described, and some details are given of the operating conditions of dry-reed-relay cross-points.

621.395.345

8137 LINE-SCANNING PROCESSES IN A MAGNETIC-DRUM-CONTROLLED ELECTRONIC TELEPHONE EXCHANGE. R.G.Knight and R.D.Allum.
Proc. Instn Elect. Engrs, Paper 3418 E, publ. Nov., 1960, 3 pp. [Conference on Electronic Telephone Exchanges]. To be republished in Vol. 108 B (1961).

In an electronic telephone exchange shortly to be installed at Highgate Wood, and using the time-division-multiplex principle, a magnetic drum is used to generate cyclic waveforms which are used to control the testing of subscribers' lines and also the transmission of information between the drum store and other sections of the exchange. The problem of non-synchronous operation and widely differing time scales between the drum and the speech multiplex are discussed.

621.395.345

8138 MAGNETIC-DRUM STORAGE AND ORIGINATING CALL DETECTION IN AN ELECTRONICALLY CONTROLLED T.D.M. TELEPHONE EXCHANGE.
D.G.Bryan and J.S.Arnold.
Proc. Instn Elect. Engrs, Paper 3419 E, publ. No., 1960, 4 pp. [Conference on Electronic Telephone Exchanges]. To be republished in Vol. 108 B (1961).

Deals with the detection and connection of calling subscribers to the equipment of an electronically controlled t.d.m. telephone exchange. In particular, it refers to the types of information for which storage is required, to the method of providing this on a magnetic drum and to the logical manipulation of this information when a call occurs.

621.395.345

8139 A MAGNETIC-DRUM-TYPE AUTOMATIC TRAFFIC EQUIPMENT WITH TRANSISTOR SWITCHING ELEMENTS. T.H.Clark, I.S.Thomson and C.K.Price.
Post Off. elect. Engrs' J., Vol. 53, Pt 1, 50-3 (April, 1960).

With the object of proving transistors in service as high-speed switching elements for telecommunications, an ancillary equipment consisting of a simple traffic equipment (routiner) built around a magnetic drum and transistor elements was constructed for continuous automatic testing of the experimental drum-type register–translator now in continuous traffic service at Lee Green Exchange (London area). In the routiner, a programme of 20 test calls is stored in a "library section" on the magnetic drum in the form of directory numbers and the appropriate routing translation. Testing is initiated by sending trains of pulses from the routiner to the exchange register–translator, and the translation is returned to the routiner for comparison with the library record. A successful check initiates clear-down and steps on the routiner to the next test. A faulty check is metered, and may be alarmed (at the option of the maintenance staff) before passing on to the next test. The equipment is housed in a 6 ft 6 in. bay, 12 in. deep, and comprises a logical-circuit system of printed-wiring boards, a 6 inch diameter magnetic-drum, a control panel, the necessary message-registers for fault metering, together with relays, a uniselector, cold-cathode tubes and power supplies. Total power consumption is less than 200 W. The installation has demonstrated the importance of efficient elimination of high frequency interference in electronic equipment of this character, and has already been instrumental in bringing obscure faults to light in the register–translator equipment. W.J.Mitchell

621.395.345

8140 THE APPLICATION OF DIGITAL COMPUTER TECHNIQUES TO ELECTRONIC AUTOMATIC TELEPHONE SWITCHING SYSTEMS. D.K.Melvin.
Proc. Nat. Electronics Conf., Vol. 15, 593-605 (1959).

Describes the basic principles of crosspoint and time-division-multiplex electronic telephone switching systems with an emphasis on the digital-computer techniques used in controlling the voice transmission paths. The requirements for logic, temporary and permanent memory, recirculating memories, registers, and buffer storage are discussed. Time sharing of control equipment which enables dial pulses from many subscriber's telephones to be registered simultaneously is also possible with these high speed techniques. A recirculating magnetostriction delay line which records dial pulses and remembers the appropriate time-slot to be used for multiplex transmission is compared with a recirculating ferrite-core memory which serves a similar purpose. The advantages of using

Boolean algebra in the design of electronic telephone systems for reducing the number of components and simplifying the resulting circuitry are discussed.

621.395.36

8141 TELEPHONE TRAFFIC MEASUREMENT OVER EXTENDED PERIODS. A.Ellin and I.Tånge.
Tele (Swedish Edition), 1960, No. 1, 197-216. In Swedish.

Measurements on the routes Malmö-Copenhagen and Malmö-Gothenburg have been carried out for over 12 months at 15-minute intervals enclosing the busy hour. Full details of the results are given. H.Jefferson

621.395.44

8142 ASSESSMENT OF THE MAXIMUM TOLERABLE PARASITIC VOLTAGES IN CARRIER FREQUENCY CHANNELS ON HIGH VOLTAGE LINES AND SUGGESTIONS FOR A MINIMUM LEVEL OF RECEIVED HIGH FREQUENCY SIGNALS. H.Fleischer and G.Graff.
Elektrizitätswirtschaft, Vol. 58, No. 22, 775-81 (Nov. 20, 1959). In German.

Due to the high level of corona noise, reception of these in carrier-frequency connections is generally not as good as in commercial carrier-telephony connections conforming to C.C.I.R. and C.C.I.T.T. rules. Listening tests with various noises prove that reception is nevertheless sufficiently good; but any deterioration due to radiation from radio transmitters must be avoided. Methods and diagrams are given to calculate the effects of this radiation. It is often necessary to avoid using a channel at the frequency of even a distant transmitter, particularly for supervisory control. The improvement gained by phase-to-phase or system-to-system coupling compared with phase-to-ground coupling is not important. H.R.J.Klewe

621.395.44

8143 THE C200A SMALL DIAMETER COAXIAL SYSTEM. B.S.Helliwell and F.Wilkinson.
A.T.E.J., Vol. 16, No. 1-3, 13-31 (Jan.-July, 1960).

This system, designed to meet the requirements of the British Post Office and meeting full C.C.I.T.T. transmission standards, provides a transmission path for up to 300 telephony circuits using a pair of small diameter coaxial tubes in buried or aerially suspended cables with associated repeaters installed underground. A description of the physical and electrical characteristics of the cable is first given followed by a discussion on system planning. The line amplifiers and regulators are then described, also the repeater housings and their installation. References are made to test facilities, alarm and supervisory provision and the trial installation between Slough and Reading.

621.395.44

8144 TRANSISTORISED THREE-CIRCUIT CARRIER TELEPHONE EQUIPMENT FOR OPEN-WIRE LINES. SYSTEM SPO. 1012.
G.E.C. Telecomm., No. 30, 29-38 (July, 1960).

This equipment provides three high-quality speech circuits each effectively transmitting the band 300 c/s to 3400 c/s, and each having out-of-band signalling at 3825 c/s. In addition, the system permits the transmission of four duplex voice-frequency telegraph channels and a physical circuit of up to 2700 c/s. When required, 24 voice-frequency telegraph circuits can be provided over any of the carrier telephone circuits. Alternatively, a bothway broadcast-programme circuit of approximately 10 kc/s bandwidth may be inserted at the intermediate frequency of 84 kc/s to 96 kc/s instead of the three speech circuits. The equipment operates from either 24 V d.c. or a.c. mains supply. The use of transistors combined with other modern miniaturization techniques allows a complete terminal equipment to be mounted on a single rackside 6 ft high, or two terminals on a single rackside, 9 ft high.

621.395.44 : 621.376.55

8145 P.P.M. 60 - A TRANSISTORIZED P.P.M. SYSTEM FOR 60 CHANNELS. H.M.Christiansen and M.Schlichte.
Nachrichtentech. Z. (N.T.Z.), Vol. 13, No. 8, 392-9 (Aug., 1960). In German.

A newly developed p.p.m. system for a maximum of 60 telephone channels is described. It is fully transistorized. For the purpose of noise reduction each channel is provided with an instantaneous compandor. C.C.I.R. recommendations for long-distance communications are easily met. The 60 channels are subdivided into five groups with separate modulation units. One channel carries an identification frequency for synchronization. Special equipment permits the branching of channel groups and individual channels. Characteristic data of the equipment are given and some circuit details are described.

621.395.44

8146 USE OF COMPANDORS IN CARRIER TELEPHONY SYSTEMS. J.Čermák.
Slaboproudy Obzor, Vol. 21, No. 9, 514-20 (1960). In Czech.

The principle of a syllable-controlled compandor is explained and it is shown that the variable attenuation elements of the system can be provided by semiconductor diodes or metal rectifiers. The compressor of the compandor is based on a network consisting of a resistance and diode connected in series, where the output voltage is taken across the diode. The dynamic resistance of the diode is varied by means of a polarizing current which is proportional to the output voltage. In the expandor the procedure is reversed in that the output signal is taken from across the resistance. The operation of the system is analysed in detail. It is shown that though the system combats noise, it introduces harmonic distortion. Practical circuits of a compressor and an expandor are given and a transistorized compandor is described. R.S.Sidorowicz

621.395.44

8147 AN ALL-TRANSISTORISED TRUNK CARRIER SYSTEM [565]. F.H.Gardner.
Trans Amer. Inst. Elect. Engrs I, Vol, Vol. 79, 212-16 (1960) = Commun. and Electronics, No. 49 (July, 1960).

Provides 5 carrier channels of 250 to 3000 c/s bandwidth in addition to a physical channel, together with a supervisory signalling channel for each at 3500 c/s, and transmission may be at 150 or 600 ohms. Five channel panels and a common filter-and-matching panel are mounted on 19-inch racking to constitute a terminal, and each channel panel comprises ten plug-in assemblies for jacks etc, filters, attenuators, modulators, crystal carrier oscillator, v.f. equipment, and signalling equipment. The equipment is of the amplitude-modulated double-sideband, transmitted carrier type, and in the case of signalling, provision is made for tone-idle and tone-busy modes of operation at choice. The completely transistorized receiver amplifies, detects and controls the output level within ±1 dB for carrier input levels varying between −13 and −28 dBm. Power consumption per channel is 70 mA at 48 V. Detailed circuitry for the "signalling card" is shown, together with filter and other transmission characteristics. A companion system by Stromberg-Carlson to their 561 Subscriber Carrier System (see Abstr. 1563, 3741-2 of 1958). W.J.Mitchell

621.395.44 : 621.398

8148 THE EFFECT OF DELAY DISTORTION ON DATA TRANSMISSION. P.Mertz.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 228-32 (1960) = Commun. and Electronics, No. 49 (July, 1960).

A brief review of the relations between phase shift and delay is given. The effects of echoes on noise tolerance are discussed and a diagram permitting simple evaluation of the noise penalty in specific cases is shown. This is followed by a discussion on selection of distortion and envelope delay tolerances. Finally, a table listing basic tolerances in echo amplitude, phase ripples and envelope delay ripples for various noise penalties, for a.m. transmission, is included. M.Goldberg

621.395.5

8149 A COMPANDOR FOR THE TRANSMISSION OF BROADCAST PROGRAMMES BY TELEPHONE LINKS. W.von Guttenberg and H.Hochrath.
Nachrichtentech. Z. (N.T.Z.), Vol. 13, No. 1, 9-15 (Jan., 1960). In German.

Long-distance transmission (up to 2500 km) introduces noise at a level of some 12 dB higher than good quality permits. This disadvantage can be met by compression of source and expansion of received signals, thus achieving transmission of weak signals at a relatively high level with consequent improvement in s.n.r. and crosstalk at the receiver. Instantaneous and controlled (syllable) compandors, the latter with separate or pilot control channel, are discussed in terms of distortion and channel requirements. An experimental trials equipment and its performance are described. 3 references. A.Reiss

TELEPHONE EQUIPMENT COMMUNICATION NETWORKS AND CABLES

621.395.641

8150 INTERMODULATION DISTORTION AND EFFICIENCY ANALYSIS OF MULTICARRIER REPEATERS. F.Assadourian.
I.R.E. Trans. Commun. Syst., Vol. CS-8, No. 1, 68-71 (March, 1960).

A fresh approach to an old problem to obtain relationships between distortion or efficiency and input power for a third-degree nonlinearity. Assumptions made are that the repeater bandwidth accommodates the combined bandwidths of the modulated carriers but is small compared to any frequency within it, and that the unmodulated carriers are equally spaced within the pass band and have equal levels. For the case considered, the only intermodulation components in the output are of odd order. It is also assumed that the frequency transfer characteristic of the repeater is flat in amplitude and linear in phase over its pass band. Two extreme cases are considered: the input modulated carriers are replaced (1) by unmodulated single-sideband tones of the same total power as the modulated carriers; and (2) by flat Gaussian noise of the same total power. Distortion results for the actual case of modulated carriers then lie between the two extreme cases. The analysis is applied to a klystron power amplifier and the results plotted against a "bunching parameter". An output signal-to-distortion ratio of 25 dB corresponds to a practical efficiency of around 6%. W.J.Mitchell

621.395.74

8151 SIXTEEN-CHANNEL BANKS FOR SUBMARINE CABLES. R.S.Tucker.
Bell Lab. Record, Vol. 38, No. 7, 248-52 (July, 1960).

A highly efficient double-modulation scheme increases the traffic-handling capacity of submarine cables by providing sixteen 3 kc/s channels instead of the usual twelve 4 kc/s channels. V.G.Welsby

621.395.74

8152 OPTIMUM SIZE OF CABLE DISTRIBUTION RANGES IN LOCAL TELEPHONE NETWORKS. H.Kremer.
Frequenz, Vol. 14, No. 5, 162-7 (May, 1960). In German.

Assuming square shape and 2-hectare size of house blocks in Western Germany, the optimum size of a cable distribution area is calculated to include 150–250 main-cable pairs. Higher capacity cable distribution boxes are required only in areas of very high building density and bypass circuits can be used to augment the capacity of distribution boxes. In areas of very low building density distribution boxes for 100, or even 50–70, main-cable pairs can give the most economical solution. Instead of using even smaller boxes, cross-connecting groups with 30–40 cable pairs are recommended. J.M.Silberstein

621.395.74

8153 TRANSMISSION NETWORK PLANNING WITH ELECTRONIC EXCHANGES. T.H.Flowers.
Proc. Instn Elect. Engrs, Paper 3373 E [Conference on Electronic Telephone Exchanges], publ. Nov., 1960, 7 pp. To be republished in Vol. 108 B (1961).

Successful telephone conversation depends upon the persons involved, their ambient conditions, the transmission characteristics of the subscribers' sets and the local lines to the terminal exchanges, the main lines between exchanges, and the exchanges themselves. Against the extreme variability of the telephone habits and abilities of the first, random variations in line and exchange speech transmission are of little account. Mean loss is important. Electronic exchanges may permit substantial reductions in mean loss throughout a network by providing the means, not present in existing exchanges, of correct and invariable impedance termination of lines and of accurate line balancing at 2-wire/4-wire terminations, by eliminating the impedance mismatches and reflections at switching points and by providing amplifiers in all lines. These same conditions may also be applied to improving the economy and possibly the transmission of local lines. Electronic exchanges using analogue speech transmission are known and exchanges using p.c.m. are being examined. There is little to choose between the two types of transmission so far as network planning is concerned. The invariant-loss feature of p.c.m. gives it some advantage in main-line transmission, but this may be a handicap in local-line provision, where some means of varying the gain according to the connection made can lead to economy and transmission improvement.

621.395.74 : 621.315.212

8154 THE COAXIAL CABLE — THEORETICAL CONSIDERATIONS. V.K.Rao.
Telecommunications (Jabalpur), Vol. 8, No. 1, 8-17 (June, 1958).

Expressions for the primary coefficients of coaxial cables are discussed. The relationships between primary and secondary coefficients are explained. An account is given of the frequency-dependence of resistance and inductance as a result of the skin effect. The discussion is illustrated by consideration of the special case of the 0.375 in. coaxial cable used for 4 Mc/s broadband telephony. The properties of this cable are given graphically and by tabulation. W.T.Blackband

ELECTROACOUSTIC APPARATUS

621.395.6

8155 ELECTROSTATIC SQUARER FOR ACOUSTIC MEASUREMENTS. J.P.A.Lochner and P.Meffert.
Electronics, Vol. 33, No. 35, 66-8 (Aug. 26, 1960).

The usual signal arrival pattern which results when a pulse is applied to an auditorium is analysed in a manner which is considered to be consistent with the integrating characteristics of the ear, the result being displayed on a digital indicator. Integration is performed over a predetermined interval with a variable delay for late reflections (>100 ms). The squaring unit is a thin dural diaphragm mounted in vacuo between the plates of a capacitor. Deflection is proportional to the square of the applied voltage and causes a differential frequency deviation of two r.f. oscillators. The sum of the deviation is measured by mixers, gates and an electronic counter (a schematic is given). It is a true r.m.s. device and is frequency-independent over a large range. It is obviously capable of other applications. Reference is made to previous articles in Acustica and J. Acoust. Soc. Amer. M.L.Gayford

621.395.61

8156 DETERMINATION OF PRESSURE SENSITIVITY OF MICROPHONES. H.G.Diestel and H.Mrass.
Archiv. tech. Messen, No. 291 (Ref. V 53-6), 65-8 (April, 1960). In German.

Pressure calibrations can be performed by reciprocity, pistonphone, thermophone, electrostatic actuator and standing-wave tube. In nearly all cases, a coupler is required. Coupler techniques in regard to adiabatic working (low heat loss), pressure equalization and hydrogen filling by capillary, wave effects and effective volume corrections are dealt with. Hydrogen filling extends the top frequency limit by a factor of four. Reciprocity theory is outlined and the formulae given. Pistonphones are calibrated at lower frequencies by microscope and by electrostatic means at higher frequencies. The well known thermophone principles are mentioned. In tubes, the antinodal pressures are calculated from the corresponding velocities measured by Rayleigh disk. The electrostatic actuator gives relative rather than absolute calibrations, owing to the difficulty of correcting for the slit-shaped electrodes etc. In all these methods, care must be taken to avoid mechanical vibrational excitation of the microphone body. A useful bibliography on microphone calibration is given. M.L.Gayford

621.395.61 : 534.6

8157 SIMPLE CALIBRATION OF SMALL VIBRATION PICK-UPS. J.H.Janssen.
Acustica, Vol. 8, No. 3, 179 (1958).

The method uses a calibrated capacitor microphone, and covers the range 0.8 to 16 kc/s. A vibrating table (Cu disk, thickness 1 cm, diam. 6 cm) is mounted at the top of a vertical travelling-wave tube (length 2 m, internal diam. 4.6 cm, with ρc-termination) and driven axially by an electrodynamic vibrator. A rubber ring seals the gap between disk and tube. The calibrated microphone is mounted half-way down the tube. The pick-up is mounted on the table outside the tube. Above 4.3 kc/s hydrogen must be used instead of air to eliminate higher modes which might be produced by an unsymmetrically vibrating table. C.F.Pizzey

621.395.61

8158 PRESSURE AND FREE FIELD RECIPROCITY CALIBRATION OF MICROPHONES. R.W.Benson.
Proc. Nat. Electronics Conf., Vol. 15, 105-10 (1959).

The reciprocity technique of microphone calibration has been accepted as the primary method of calibrating laboratory standard microphones. The present American Standard describes the application of this technique for pressure measurements only. Since most users of microphones are interested in their free-field performance, a free-field calibration is often desired. The procedures which are currently available allow for calibrations up to 100 kc/s. Both pressure and free-field calibrations are discussed as well as the accuracy obtainable by this method. Data is given indicating the performance of some commercial laboratory microphones.

621.395.616

8159 THE ASSESSMENT OF THE MERIT OF MICROPHONES BY A CORRELATION TECHNIQUE. F.Krieger.
Nachrichtentech. Fachber. (N.T.F.), Vol. 15, 17-20 (1959). In German.

It would be advantageous to have a performance criterion given by a single measurement under conditions of wideband noise excitation. If the output of a microphone is compared with the original signal by means of a correlator, the correlation coefficient gives a measure of the fidelity of transduction. A system is described in which the time-delay function of the correlator is performed by the use of a relatively perfect e.s. microphone, a suitable longitudinal displacement being introduced between this and the test microphone. Matched microphone amplifiers are used. True r.m.s. meters read each output and the difference between the outputs, the correlation coefficient being simply derived from these 3 readings. The noise sound field is assumed to be independent of frequency over the range concerned and the anechoic room is assumed to be reflection-free. Results are given on some crystal, magnetic and carbon microphones of which the response curves are also given. Correlation coefficients between 0.69 and 0.955 were obtained. It would appear that this figure of merit is not a very sensitive index for high quality microphones, any asymmetry of the sound field due to source diffraction effects etc., presumably placing a limit on the accuracy of the method. M.L.Gayford

621.395.62

8160 ARTICULATION AND BINAURAL LISTENING. K.Wendt.
Nachrichtentech. Fachber. (N.T.F.), Vol. 15, 21-4 (1959). In German.

For binaural listening, articulation depends on the spatial relations of the signals concerned as well as on their intensities and spectra. Reference is made to experiments by Hirsch and Licklider in which headphones were used. In the tests described, observers in anechoic and reverberant conditions listened to word lists, disturbing noises being simultaneously reproduced on the same or other loudspeaker arrays, the relative intensities being varied. The results are summarized in curves and bring out the relative importance of the room acoustics. The work has a bearing on the problems of effective sound coverage in noisy locations as well as on basic stereophonic and psychoacoustical problems.
M.L.Gayford

621.395.62

8161 IMAGE LOCATION FOR VARIOUS STEREOPHONIC SYSTEMS. P.Scherer.
Nachrichtentech. Fachber. (N.T.F.), Vol. 15, 36-42 (1959). In German.

A good degree of positional location is provided by the present two-channel systems which depend mainly on inter-channel time-difference, intensity difference, or both. Studies and measurements are described which had the object of defining and measuring the precision of image location for various arrangements. The concepts of "image sharpness" and the "bunching factor" are introduced. It is emphasized that the results of subjective observations have to be interpreted statistically. Experiments are described in which sound sources (steady, warbled and interrupted tones, noise bands etc.) are used with various microphone arrangements and acoustic environments. The results are plotted in the form of curves.
M.L.Gayford

621.395.62

8162 SPECIAL PROBLEMS OF STEREOPHONIC REPRODUCTION. W.Schlechtweg.
Nachrichtentech. Fachber. (N.T.F.), Vol. 15, 43-6 (1959). In German.

Present stereo disk constants are summarised. Factors such as the dependence of cross talk on groove angle error are discussed. Cross-talk is considered to shorten the reproduced baseline and may be compensated to some extent by increasing loudspeaker separation. In most stereo pickups, cross-talk is considerably dependent on frequency. Excessive intermodulation is another difficulty. Channel balancing and phasing are discussed. The use of impulsive sounds with reverberant reflections as phasing signals is discussed. There is a change in the apparent movement if the phasing is wrong.
M.L.Gayford

621.395.62

8163 INVESTIGATION OF STEREOPHONIC ROOM ACOUSTICS USING MODELS. E.Krauth.
Nachrichtentech. Fachber. (N.T.F.), Vol. 15, 51-5 (1959). In German.

Model auditoria were made and studied in order to facilitate acoustic design. Supersonic transducers were used at frequencies scaled up in proportion to the scale factor, an h.f. tape recorder being used to record the results. The small dual-unit loudspeakers (dynamic and electrostatic) reproduced up to 100 kc/s. Special electrostatic microphones mounted in a scaled-down artificial head were used to produce a stereophonic recording of the sound field. Precise control of humidity and corrections for air absorption were applied to the model. The absorption of the boundaries had to be adjusted empirically. This is admitted to be a major difficulty and further work is needed on this point.
M.L.Gayford

621.395.62

8164 OPTIMUM PERFORMANCE FROM MONOPHONIC RADIO TRANSMISSION. G.Steinke.
Tech. Mitt. BRF, Vol. 4, No. 1, 21-32 (March, 1960). In German.

The advent of wide frequency-range broadcasting due to v.h.f. and the consequent use of high-fidelity monitoring loudspeakers has led to considerable improvements in studio acoustical techniques generally. Stereo may lead to further changes and improvements. In any case, it is felt that studio techniques are so much better now than before that the listening end (receiver and room) is now the limiting factor. Some reliable subjective criteria of the overall performance at the listening end are needed. Receivers are still capable of improvement, but mere sales-catching gadgets, trick devices and tone controls are decried. A lengthy general discussion of monophonic reproduction, stereo and compatibility follows on generally familiar lines. 33 references are given in the bibliography.
M.L.Gayford

621.395.623.73

8165 ANALYSIS OF THE ELECTROSTATIC PLANE LOUDSPEAKER. I.Biryukov.
Latv. PSR Zinat. Akad. Vestis, No. 2(151), 57-62 (1960). In Russian.

An equivalent electrical circuit is derived for a wide-band electrostatic loudspeaker and the frequency characteristics in the audio range are deduced by mathematical analysis. The results are compared with experiment. Good agreement is obtained.
A.E.I.Research Laboratory

621.395.625

8166 SOUND IN DIRECT 16 mm FILM PRODUCTION. W.S.Bland.
Brit. Kinematogr., Vol. 37, No. 1, 4-18 (July, 1960).

Reviews the technique, limitations and standardization of 16 mm sound films and equipment. As the speed is only two-fifths of that of 35 mm film it would seem reasonable to expect the performance to be reduced in proportion (e.g. 3 kc/s bandwidth compared to the 7.5 kc/s normally recorded for dialogue on 35 mm). In fact, 5 kc/s is expected on 16 mm and thus a correspondingly high standard is imposed on films, printing, projector slit-width etc. The advantages of magnetic sound track are mentioned, together with some of its limitations. Non-linearity and noise remain as considerable problems in photographic sound tracks. A plea is made for further standardization of such points as reproducer characteristics and the position of synchronizing marks.
M.L.Gayford

621.395.625.2

8167 STEREOPHONIC GRAMOPHONE DISKS. H.W.Steinhausen.
Nachrichtentech. Fachber.(N.T.F.), Vol. 15, 47-50 (1959). In German.

General properties of stereophony are reviewed. Pseudo-stereophony is regarded as inadequate, but two-channel systems afford increased realism due to spaciousness etc., in addition to location. Stereophony on radio, tape and disk is discussed as well as problems of compatibility and standardization. Stereophonic-disk groove details and constants are reviewed. It is suggested that the demands of compatibility should not be allowed to prevent optimum results being achieved. Realistic stereophony is said to demand greater loudness levels than are tolerated for monophonic reproduction. M.L.Gayford

621.395.625.3 : 621.396.96

8168 APPLICATION OF THE TV TAPE RECORDER TO RADAR SIGNAL RECORDING. A.W.Severdia.
J. Soc. Motion Picture Televis. Engrs, Vol. 69, No. 6, 401-3 (June, 1960).

With a few comparatively simple modifications, the standard Ampex videotape recorder can be made suitable for this application. The principle modification is the elimination of the head-switching transients which in normal television recording are placed outside the picture area. In radar recording 0.5 μsec gating pulses derived from the head-switching circuits blank out the radar information during the transient periods. The clamp circuit too has to be modified for operation with the pulsed radar signals. Peak flutter amounts to about 0.0033%. Long-term time-base stability can be achieved by the provision of a crystal-controlled frequency standard for the drive. On the other hand, a steady mains supply will ensure a time-base length stability within about 1%. Signals associated with azimuth and elevation synchro circuits are easily included as desired. H.G.M.Spratt

621.395.625.3

8169 A METHOD OF REPRESENTING THE GAP FIELD OF A TAPE-RECORDER HEAD AND ITS APPLICATION TO THE PLAY-BACK PROBLEM. G.Schwantke.
Acustica, Vol. 7, No. 6, 363-71 (1957). In German.

By using Green's method, an approximate representation of the potential and field distribution can be obtained. In another method using Fourier transforms, the field distribution can be obtained in a simple integral form which can be generalized to apply to more complicated boundary conditions. V.G.Welsby

621.395.625.3 : 621.317.39

8170 PRECISE MEASUREMENT OF WOW AND FLUTTER. J.T.Mullin.
Electronics, Vol. 33, No. 26, 100-2 (June 24, 1960).

The equipment is intended primarily for testing instrumental tape recorders. A 40 kc/s signal recorded on the tape is played back through a limiter and discriminator so reproducing the wow and flutter components. The output amplifier is flat from d.c. to 4 kc/s so that not only normal wow and flutter but modulation due to tape vibration is also reproduced. A c.r.o. is used as an output indicator with a time base which can be synchronized with any of the wow or flutter frequencies. The time-base frequency control and the vertical excursions are calibrated so that full information on all the wow and flutter components can be determined. H.G.M.Spratt

621.395.625.3

8171 MAGNETIC SOUND TRACK FOR 8-mm HOME MOVIES. J.M Moriarty, R.B.Johnson and R.J.Roman.
Electronics, Vol. 33, No. 35, 61-3 (Aug. 26, 1960).

The magnetic stripe is 0.03 in. wide and located 0.002 in. from the edge of the sprocket-hole side of the film. The film transport system in the neighbourhood of the heads embodies a low-pass mechanical filter to eliminate wow and flutter. The heads are constructed of the aluminium-iron alloy Alfenol to prevent rapid wear at the airgaps. The record amplifier consists of a 2-stage voltage amplifier and an output stage. The same valves are employed on playback but a common-emitter transistor stage acts as a pre-amplifier. A 40 kc/s valve oscillator provides bias and erase current. The response curve is reasonably flat from 70 c/s to 7 kc/s. Switching arrangements and constructional details are described. H.G.M.Spratt

621.395.625.3

8172 WOW AND FLUTTER COMPENSATION. R.L.Peshel.
Instrum. Control Syst., Vol. 33, No. 3, 430-1 (March, 1960).

With f.m. data recording on magnetic tape the true flutter may be low but other associated noise sources such as imperfect tape-head contact and circuit noise must also be taken into account in the compensating system. With a constant-frequency reference signal recorded on one of the tracks two compensation methods are possible, namely subtraction compensation and pulse-area control. Comparison tests at 15 in/sec show that pulse-area control is superior at low frequencies by some 10 dB but above about 300 c/s the two techniques are equal. It is suggested that further improvement can only be effected by reduction in amplitude modulation and better data handling. H.G.M.Spratt

621.395.625.3

8173 TIME SCALE EXPANSION OF MAGNETIC-TAPE RECORDS. M.E.Anderson.
Instrum. Control Syst., Vol. 33, No. 3, 434-5 (March, 1960).

Describes a magnetic modulator playback head, i.e. one which senses tape flux and not its differential. In the neighbourhood of the gap the head is conventional in form but at the back the magnetic circuit is closed by two saturable strips which are magnetized by an h.f. exciting current in the range 10-400 kc/s. The head output takes the form of an h.f. signal amplitude-modulated by the tape signal. A strong second-harmonic component is present which must be filtered out. The output falls with very short and very long recorded wavelengths, as with normal heads, but within these limits it remains constant independent of tape speed. Two applications are described: (1) detailed analysis of recorded transients; and (2) machine tool control in the textile industry. H.G.M.Spratt

621.395.625.3

8174 THE SENSITIVITY OF REPRODUCING HEADS IN HIGH-FREQUENCY MAGNETIC RECORDING SYSTEMS. W.T.Frost.
I.R.E. WESCON Convention Record, Vol. 4, Pt 5, 46-9 (1960).

The sensitivity of a reproducing head in high-frequency magnetic recording systems is defined in terms of the frequency losses in the head core. A calculation is made of the variation in sensitivity with frequency in a high-frequency reproducing head and a method of measuring the sensitivity presented with experimental results.

621.395.625.3

8175 APPLICATION OF 35 mm SPROCKET-HOLE FILM TO INSTRUMENTATION RECORDING.
J.W.Stafford and G.R.Crane.
J. Soc. Motion Picture Televis. Engrs, Vol. 69, No. 8, 528-33 (Aug., 1960).

Performance characteristics of flutter, drift, skew and general operational stability of a typical transport system using 35 mm perforated film are given. Standard 5-mil cellulose acetate, as well as 3-mil and 1½-mil Mylar base films, is included at speeds of 9-126 in./sec. Analysis of performance serves to indicate advantages to be gained in applying sprocket-hole film to instrumentation recording.

621.395.625.3

8176 HISS REDUCTION IN MASTER TAPE MACHINES. A.A.Goldberg and E.L.Torick.
Proc. Nat. Electronics Conf., Vol. 15, 129-40 (1959).

Although the signal-to-noise ratios of most professional tape recorders are considered good by present standards a low level noise still exists in the absence of programme. The noise is heard as hiss because it is coloured by the frequency characteristic of the ear. Hiss reduction is accomplished by a new equalization that increases the tape loading in the frequencies between 1000 and 15 000 c/s. The new equalization results in a subjective hiss reduction of 6 dB. Means are described to convert a professional tape recorder to the new equalization.

621.395.625.3

8177 PROBLEMS ENCOUNTERED IN WIDE-BAND FREQUENCY MODULATION. D.D.Wilcox.
Proc. Nat. Electronics Conf., Vol. 15, 173-81 (1959).

An f.m. system for the recording of very wide-band signals in which the modulating frequency closely approaches the carrier frequency is described. The difficulties involved in detecting the

f.m. components, and the various factors which contribute to the problem, are discussed. It is shown that the success of a wide-band recorder depends upon careful consideration of several unusual design factors as circuit design proceeds. Use of transistors in the circuits is discussed, and it is shown that carefully designed circuits can be used when wide-band recording is desired.

621.395.625.3

8178 SOME NEW TECHNIQUES IN AIRBORNE DATA ACQUISITION. M.E.Harrison and E.P.Brandeis.
Proc. Nat. Electronics Conf., Vol. 15, 884-95 (1959).

Discusses the present state of the art in data acquisition and takes note of recent improvements. Newly developed recorder systems are used for purposes of illustration. An indication of some future applications is shown. The major design requirements of an airborne magnetic tape recorder are presented and some interesting design features are discussed.

621.395.625.3

8179 SOME THEORETICAL AND DESIGN PROBLEMS OF REPRODUCING MAGNETIC HEADS. O.V.Poritskii.
Radiotekhnika, Vol. 15, No. 9, 64-7 (Sept., 1960). In Russian.

An analysis of electromagnetic characteristics of modern tape heads is presented, based on methods suggested by E.D.Daniel and P.E.Axon (Abstr. 2667 of 1953). Formulae for magnetic resistances of the core and in the gap, induced magnetic currents and obtainable output voltage, not neglecting leakage-field effects and tape surface phenomena, are derived and discussed. Experimental investigations are described and illustrated by a graph plotting current versus ratio of core and gap magnetic resistances, with various flux paths as parameters. Basic procedure for designing efficient heads with good frequency response and low distortion is briefly given.
A.Landman

621.395.625.3 : 621.374.32

8180 PULSE BIAS. Yu.P.Drobyshev.
Radiotekhnika, Vol. 15, No. 9, 68-70 (Sept., 1960). In Russian.

If a conventional method of high-frequency biassing is used for recording a 0.1 μs pulse on magnetic tape, then the bias frequency must be of the order of 50 Mc/s. The method described here is to apply a bipolar pulse whose amplitudes have been carefully chosen so that in the absence of a signal the nett effect on the tape is zero. If a pulse signal arrives during the time that bipolar bias is acting then it may be recorded in a linear fashion. Pulses narrower than a bias pulse can be recorded but the system is most successful when the signal duration is of the same order as the bias duration. Experimental measurements are reported for recording of a 0.1 μs pulse on tape moving at 50 cm/s. An additional use of the technique is to provide a logical-and type element.
S.C.Dunn

RADIOCOMMUNICATION

621.396.1

8181 IMPLEMENTATION OF A MODERN COMMUNICATION SYSTEM ON A NATIONAL AND A GLOBAL BASIS. C.K.Chappuis.
I.R.E. WESCON Convention Record, Vol. 4, Pt 6, 115-28 (1960).

621.396.2 : 621.396.65

8182 AN EXPERIMENTAL "SHORT-HOP" MICROWAVE SYSTEM. C.L.Ruthroff and L.C.Tillotson.
Bell Lab. Record, Vol. 38, No. 6, 202-6 (June, 1960).

The original TD-2 systems used in the Bell networks are being supplemented by the TH radio-relay system for the long, heavy-traffic routes and by the TJ system for lighter-traffic routes of moderate length. A new experimental system of simplified design has been in continuous operation since Dec., 1957, at the research laboratories at Holmdel, New Jersey, with outstanding reliability and transmission performance. The transmitter operates at 11 kMc/s with a baseband of 2 Mc/s, over a 2-hop loop from the laboratories to a repeater tower on a hill about 2 miles away and back again. The basic concept is a system with repeater spacing of 5-10 miles instead of the 30-mile spacing for the earlier systems, so that the tall repeater towers would not be needed. At the base of the towers used, a fairly small cabinet contains the complete transmitter, receiver and power-supply unit, with provision for emergency operation in case of failure of local power, the system being normally routed along existing roads. Various new components and techniques used in the experimental system are described. A minimum amount of maintenance has been required. Further modifications tending towards more efficient and low-cost operation are being investigated.
A.Wilkinson

621.396.2 : 621.396.65

8183 OVER-HORIZON RADIO LINK. K.Hoffman.
Elektrotech. Z. (E.T.Z.) B, Vol. 12, No. 13, 320-4 (June 27, 1960). In German.

Describes a 120-channel speech communication link, on 2 Gc/s, between Berlin and Western Germany, consisting of standard equipment with the following modifications: power increased from 5 to 1000 W, aerial paraboloids increased in diameter from 3 to 10 m, diversity reception and a receiver with improved noise figures (3dB) and a.g.c. range of 100 dB.
A.Reiss

621.396.2

8184 PERFORMANCE IMPROVEMENT IN SINGLE-CHANNEL VOICE COMMUNICATION RADIO SYSTEM IN SPACE. L.P.Yeh.
Proc. Nat. Electronics Conf., Vol. 15, 151-62 (1959).

Explores the possibilities of improving the performance of a single-channel voice communication radio system, when the transmitter power is at a premium, as when communicating in space. Due to weight and space limitations imposed on the equipment, more elaborate and complex schemes are excluded from discussion. The only techniques covered are a.m. (double-sideband with full carrier), d.s.b.s.c. (double-sideband suppressed-carrier), s.s.b. (single-sideband) and n.b.f.m. (narrow-band frequency-modulation — an f.m. channel restricted to a.m. spectrums). Furthermore, only system performances are discussed; equipment designs are omitted.

621.396.2 : 621.396.65

8185 THE CARRYING CAPACITY OF BALANCED LINKS WITH VARIABLE PARAMETERS AND UNLIMITED FREQUENCY BAND. L.M.Fink.
Radiotekhnika, Vol. 15, No. 7, 21-8 (July, 1960). In Russian.

Starts from Shannon's formula for the carrying capacity C, taking a given power ratio of signal to spectral density of white noise. An expression is obtained for unlimited frequency band similar to that of Woodward and Davies (Abstr. 339 of 1951). Further working assumes (a) duplex coding; (b) presence of non-additive noise; (c) fading; (d) any balanced m-position code. A comparative table gives the various formulae for C obtained here and elsewhere.
D.E.Brown

621.396.2

8186 WIRELESS INTERPRETING AND ADMINISTRATION (COMMUNICATION) INSTALLATIONS. H.J.Griese and D.Burchard.
Radio Mentor, Vol. 38, No. 5, 368-75 (May, 1960). In German.

Describes a multi-channel system using an inductive loop surrounding the area served. The system is limited to a max. frequency of 135 kc/s and a max. field of 3-0.25 AT (depending upon frequency). Experience shows that, to avoid inter-channel interference, all carrier frequencies should be odd harmonics of one fundamental frequency and, in the neighbourhood of television studios, odd harmonics of half the line frequency. A.M. is found preferable to f.m., log.-law detection provides additional safeguards against adjacent channel interference and, if the modulation characteristic is exponential, freedom from distortion also. Both transmitter and receiver are described in some detail. The latter, which is pocket-sized, embodies four transistors and printed circuits.
H.G.M.Spratt

621.396.3

8187 INTERMITTENT COMMUNICATION OF FREQUENCY MODULATED BINARY CODE. K.Ikushima.
J. Radio Res. Lab. (Tokyo), Vol. 6, 573-93 (July, 1959).

The transmission of f.m. binary code may be improved if it is controlled by the circuit conditions existing at the time of transmission. Three methods are discussed. Firstly the code transmission is switched on or off depending on the magnitude of a c.w. signal, from the receiver station, relative to a threshold value.

Secondly the c.w. signal from the receiving station controls the code transmission by binary f.m. which in turn depends on the strength of the main transmission at the receiver. Finally a combination of the first two methods is considered. The treatment is theoretical and discusses communication parameters such as element error rate etc. for each method. Several approximations are made and no practical results are quoted. H.L.Nattrass

621.396.2

8188 A REVIEW OF SINGLE-SIDEBAND TECHNIQUE. R.Faessler.
Schweiz. tech. Z. (S.T.Z.), Vol. 57, No. 1, 685-93 (Sept. 1, 1960). In German.

A study of the three methods of suppressing the carrier and one sideband. These three methods are: (1) the phase difference method; (2) the use of filters; and (3) a method which is in the nature of a combination of methods (1) and (2). This last-named method has the advantage that, even with indifferent sideband suppression, no interference outside the transmission channel occurs. H.G.M.Spratt

621.396.44

8189 BROADCAST ENTERTAINMENT BY WIRE.
Wireless Wld, Vol. 66, No. 5, 208-14 (May, 1960).

A review of the development and present position of sound and television relay services. For sound broadcasting rediffusion at a.f. has long been established. For television a number of systems are employed. These include: (1) a communal aerial system; (2) low-carrier-frequency systems using screened quadruple cable for 2-programme services; and (3) central distribution systems. Some of the central stations and receiving sets provided are briefly described. The future prospects of relay services are discussed with emphasis on the political aspects of the subject. H.G.M.Spratt

621.396.441

8190 A MONITOR FOR 7-UNIT SYNCHRONOUS ERROR-CORRECTING SYSTEMS FOR USE ON RADIO-TELEGRAPH CIRCUITS.
R.P.Froom, F.J.Lee, C.G.Hilton and P.Mackrill.
Post. Off. elect. Engrs' J., Vol. 53, Pt 1, 1-8 (April, 1960).

The design and construction are described of a monitor unit for measuring the character-error rate on working radio-telegraph circuits. The instrument can be used on 2-channel and 4-channel character-interleaved systems and also on 2-channel element-interleaved systems using single-element interleaving. Detailed descriptions, with schematic circuit diagrams, are given of the synchronous-regenerator and error-detector units, which are the principal components of the monitor. The counters used are conventional in design. Practical tests of three of the monitors on teleprinter systems were satisfactory. A.Wilkinson

TRANSMITTERS . RECEIVERS

621.396.61

8191 THE DESIGN OF THE NEW BROADCAST TRANSMITTER AT MOTALA.
E.Magnusson and F.Strandén.
Rdfunktech. Mitt., Vol. 4, No. 3, 94-101 (March, 1960). In German.

The signal from the existing 150 kW 191 kc/s transmitter suffers from fading and interference from foreign transmitters at ranges of beyond about 100 km. Accordingly, the power is being increased to 600 kW, the location shifted and a new ring aerial constructed. The latter will consist of a 250 m central mast and five 200 m masts arranged symmetrically around it at a radius of 650 m. The design of the aerial, for which small-scale models were constructed, and of the earth mat is described in detail and vertical polar diagrams are given. H.G.M.Spratt

621.396.61

8192 A METHOD OF REDUCING DISTORTION IN F.M.KLYSTRON TRANSMITTERS.
A.F.Evers, G.G.Kemp and S.F.Pearce.
Brit. Commun. and Electronics, Vol. 7, No. 8, 590-3 (Aug., 1960).

Direct-modulation and i.f. modulation methods in microwave links are reviewed and an improved technique is described which increases the channel handling capacity of the direct-modulation method without the complexity and capital cost of the i.f. system. Experimental results are given and the lines for further development indicated. J.W.Lee

621.396.61/.62

8193 A PERSONAL TWO-WAY V.H.F. RADIO COMMUNICATION SYSTEM FEATURING MODULAR CONSTRUCTION. T.H.Yaffe.
I.R.E. WESCON Convention Record, Vol. 4, Pt 7, 74-7 (1960).

Describes a personal communications receiver assembled entirely from individual circuit modules, which are constructed with standard, commercially available, subminiature components. Defective modules can be rapidly replaced, and later repaired or modified. Other receiver features include 1 microvolt sensitivity, double conversion,a crystal filter selectivity package at the high i.f. frequency, and a novel squelch gating circuit. The companion transmitter, more conventional in construction, also is subminiaturized. It features 1 W power output, a transistorized modulator, and a d.c.-d.c. convertor type of power supply with rechargeable nickel cadmium batteries. The shirt-pocket size receiver and the transmitter occupy a combined volume of less than 85 in^3 and together weigh less than 4.5 lb.

621.396.61/.62

8194 PERSONAL RADIO PAGING IN THE V.H.F. BAND. J.F.Mitchell.
I.R.E. WESCON Convention Record, Vol. 4, Pt 7, 78-87 (1960).

Describes a complete v.h.f. radio paging system designed to operate in the 25 to 50 Mc/s and 144 and 174 Mc/s bands. The system includes small light-weight receivers which are worn by the users. The receivers can be selectively called up to many thousands on the same r.f. channel. When the receiver is called, the user hears an alerting tone. He then presses the listen button and the voice message is received. The base station is a standard land mobile f.m. transmitter. This transmitter is tone modulated by the encoding equipment to send the page alerting call. It is then voice modulated to send the message. The base encoding equipment may take several forms from the simplest which can call 90 different receivers to the most complex which can call up to 7500 receivers. The base station r.f. equipment may take many forms and may also service two-way radios on the same channel.

621.396.61/.62

8195 AN IMPROVED DOVAP TRANSPONDER. F.M.Gardner.
I.R.E. WESCON Convention Record, Vol. 4, Pt 5, 174-81 (1960).

A narrow band is obtained using a crystal filter. Doppler errors are eliminated by tracking the input signal with a combined a.f.c.—phase-lock loop. Detuning errors are minimized by certain design techniques of the a.g.c. circuitry. The resulting transponder has a 15 kc/s bandwidth and shows less than 3° phase variation within the band and over a 70 dB signal level range.

621.396.621

8196 PORTABLE RADIO USES DRIFT-FIELD TRANSISTORS. R.A.Santilli and H.Thanos.
Electronics, Vol. 33, No. 28, 48-50 (July 8, 1960).

This 9-transistor a.m.–f.m. receiver uses drift-field (h.f.) transistors for the tuner and i.f. amplifier. Three i.f. stages are employed on f.m.; two only on a.m. The circuits are fully described and tuning and noise characteristics given. A 20 dB signal—noise ratio is obtainable at field strengths as low as 25 and 140 $\mu V/m$ on f.m. and a.m. respectively. H.G.M.Spratt

621.396.621 : 621.396

8197 RADIO COMMAND SET FOR HIGH-ALTITUDE BALLOONS. R.W.Frykman.
Electronics, Vol. 33, No. 35, 54-5 (Aug. 26, 1960).

The airborne receiver has a crystal-controlled super-heterodyne using M.A.D.T. germanium transistors. The i.f. bandwidth is 5 kc/s and is guaranteed by crystal filters in the emitter by-pass circuits. The second detector is a triode in order to provide better a.g.c. An input signal range of 55 dB from 5 μv results in an audio-signal level change of 3 dB. Control is exercised in the receiver by a 3-reed resonant relay working at three frequencies between 200 and 500 c/s. The final actuating element has a 4-layer diode connected in series with the coil of a relay. S.C.Dunn

621.396.621

8198 HELMET TRANSCEIVER FOR FLIGHT DECK COMMUNICATIONS. D.C.Gibson.
Electronics, Vol. 33, No. 39, 57-60 (Sept. 23, 1960).

After a brief explanation of the need for, and specification of, a lightweight transistorized transceiver for communication purposes, a miniaturized, light (under 4 lb) duplex a.m. transceiver, operating in the 132-150 Mc/s range is described, and illustrated by two block diagrams. The transmitter is crystal-controlled and capable of 50 mW output, the receiver is a double superheterodyne. An ingenious noise-actuated automatic volume control is singled out for detailed description; its dimensioned circuit diagram is reproduced and explained. A.Landman

621.396.621

8199 THE MONITORING OF RECEIVER PERFORMANCE UNDER OPERATIONAL CONDITIONS. O.E.Keall.
Marconi Rev., Vol. 23, 53-8 (2nd Qtr, 1960).

Various techniques employed to check receiver performance are discussed. In one case an arrangement fitted to a 50 cm-band multi-purpose surveillance radar equipment makes use of a noise reference source of low insertion loss permanently coupled into the circuit but which can be switched on and off. Other methods for noise factor measurements are shown in block schematic form. J.W.Lee

621.396.621

8200 ULTRA-LOW-NOISE ANTENNA AND RECEIVER COMBINATION FOR SATELLITE OR SPACE COMMUNICATION. R.W.DeGrasse, D.C.Hogg, E.A.Ohm and H.E.D.Scovil.
Proc. Nat. Electronics Conf., Vol. 15, 370-93 (1959).

A travelling-wave solid-state maser and a low-side-lobe horn-reflector aerial were combined to realize an ultra-low-noise receiving system. With the aerial pointed vertically, overall input temperatures as low as 17.6°K were observed at 5.65 Gc/s where this figure comprises the noise contribution due to the sky, the aerial and the maser-preamplifier. Noise contributions from the following stages can easily be made negligible. Since the input temperature rises to a value near room temperature for the aerial pointed on the horizon, such a system is not fully utilized in direct point-to-point earth communication. However, in satellite or space communications, where the aerial is 10° or more above the horizon, this receiving system gives a hundred-fold improvement over present equipment. Thus, as pointed out by Pierce and Kompter, (Abstr. 3835 of 1959) it is now feasible to consider transatlantic communication by reflection of a microwave signal from a passive satellite sphere. Such a receiving system can also be used to either extend the range or increase the bandwidth of a space-probe telemetry system. The ultimate limitation in sensitivity of an earth-based receiving system is set by noise generated in the earth's atmosphere. A zenith sky temperature of 2.7°K at 6 Gc/s has been calculated. The actual value was measured, using the low-noise receiving system, by rotating the aerial and noting the sky noise variation. From this measurement a zenith sky temperature of 2.5 ± 075°K was determined. Thus it seems advisable to attempt even a lower receiving-system noise temperature. It appears that, by reduction of waveguide and coax. losses in the present system, a system noise temperature of 10°K could be realized at 6 Gc/s, while a noise temperature of 7°K is expected at 2 Gc/s, both for the vertical aerial position. Improvements under way in the laboratory indicate the feasibility of systems having an overall noise temperature of 7.5°K at 6 Gc/s and of 5°K at 2 Gc/s, respectively.

621.396.621

8201 SUMMATION OF TELEGRAPH SIGNALS ON A COMMON RESISTANCE. V.M.Rozov.
Radiotekhnika, Vol. 15, No. 5, 73-8 (May, 1960). In Russian.

The case of a diversity telegraph receiver is considered in which the summation of signals of both channels is performed on a common resistance. The summation is performed on direct current basis and the adding circuit comprises series resistances in both channels and a much smaller common resistance. It is assumed that non-linear distortion is present in the channels, that both channels have identical parameters, and that the distribution of probability density of signal magnitudes is exponential. The probability of signal distortion, i.e. of the signal on the common resistance having wrong polarity, and the improvement in quality of reception due to the diversity are analysed. The improvement increases with the operational quality of single channels, and strongly depends on the correlation between the added signals, only if the correlation coefficient exceeds 0.1. If both channels are non-linear in an identical manner, non-linearity has no influence on the operation of common system. J.M.Silberstein

621.396.621

8202 ARTIFICIAL AERIALS FOR MEASUREMENTS ON METRE WAVELENGTH RECEIVERS. C.Egidi.
Tech. Mitt. P.T.T., Vol. 38, No. 3, 66-101 (1960). In Italian and French.

To meet various possible schemes of connections, formulae are developed and numerical tables provided to enable the component values of artificial aerials to be calculated. These aerials are intended to apply to one or more standard signal generators and test receivers so as to ensure correct impedance matching for each system of connection. The particular cases considered are of a signal generator with unbalanced output-impedance connected to a receiver with unbalanced input-impedance and that of a balanced output-impedance signal-generator to an unbalanced receiver input impedance. A further development is the case of two signal generators with unbalanced output connected to either a balanced or an unbalanced receiver-input. Two variables are considered in the first case, that when the output impedances of the signal generators are equal and that when they are not. Solutions are given for the latter case using combinations of artificial aerials. Finally the general case of multiple artificial aerials for two or more generators is dealt with and general formulae are developed. Tables giving resistance values for all cases of pratical interest were calculated and correspond to normalized values of signal-generator and receiver output-and input-impedances respectively. R.J.Jordan

621.396.621

8203 REQUIRED PERFORMANCE FROM A GOOD F.M./V.H.F. RADIO RECEIVER. E.Wey.
Tech. Mitt. P.T.T., Vol. 38, No. 8, 257-71 (1960). In German and French.

A critical review of the average observed performance of commercially available f.m. radio receivers is presented, followed by a thorough discussion of required characteristics, illustrated by numerous graphs and oscillograms. Following points are considered: sensitivity and signal-to-noise performance; selectivity; immunity from impulsive interference; handling of intermodulation and multipath distortion; temperature and long-term stability of tuned circuits; level of oscillator fundamental and harmonic radiation. A.Landman

621.396.621

8204 TRANSISTOR V.H.F./F.M. RECEIVER. I-III. R.V.Harvey.
Wireless Wld, Vol. 66, No. 8, 366-9 (Aug.); No. 9, 418-22 (Sept.); No. 10, 519-22 (Oct., 1960).

A very detailed account of design, layout and performance of the receiver which is continuously tunable from 87-100 Mc/s. It embodies a v.h.f. drift transistor as local oscillator, a balanced diode mixer (to prevent radiation of oscillator power), four i.f. stages with a stage gain of 22 dB, a discriminator combined with a "dynamic diode" limiter and three a.f. stages transformer-coupled to a 1 W Class AB push–pull output stage. Oscillator stability is largely maintained by shunting a Zener diode across the oscillator power supply. The bandwidth up to the limiter is about 220 kc/s. Absolute sensitivity is 16 μV with good a.m. suppression maintained above 30 μV. To reduce screening difficulties and provide acceptable sound reproduction no attempt at miniaturization is made in the layout. H.G.M.Spratt

621.396.621.54

8205 METHOD OF COMBATING IMAGE AND HETERODYNE INTERFERENCE IN A SUPERHETERODYNE RECEIVER. B.N.Mityashev.
Radiotekhnika, Vol. 15, No. 7, 42-3 (July, 1960). In Russian.

To avoid certain specific interferences, particularly the image signal, the following method is suggested: move simultaneously the local oscillator and the intermediate frequency by an equal small increment. It is shown that this can be easily accomplished by addition of small variable capacitors. The described method has proved particularly useful for reception of short-wave signals. A.Landman

621.396.625.1 : 621.396.933

8206 AN AIRBORNE TELEPRINTER SYSTEM. J.H.Court.

Brit. Commun. and Electronics, Vol. 7, No. 9, 671-3 (Sept., 1960).

This lightweight receiving equipment is designed to receive meteorological information and periodic test messages from two stations in regular service for the Atlantic routes: Galdenoch, Scotland, and Chatham, Canada, on 121.6 and 118.8 kc/s respectively. The f.s.k. transmission operates with a frequency shift of 40-60 c/s. The crystal-controlled transistorized receiver which is capable of operating on 4 channels, drives the telegraph coils of the associated teleprinter directly. The receiving system is described in some detail. A considerable saving in time and loading on air crew is effected, especially on high-speed flights; the system, which is not fully loaded at present, can be extended to deal with other sources of information with resulting economies in broadcast channels.

A.Reiss

RADIOFREQUENCY EQUIPMENT

621.396.662 : 621.397.62

8207 PERMEABILITY TUNERS FOR TELEVISION. V.H.Piddington.

Wireless Wld, Vol. 66, No. 10, 474-9 (Oct., 1960).

The tuner covers Bands I and III and incorporates four pairs of permeability-tuned coils. Change-over from one set of coils to the other is effected by a ganged switch. The circuit consists of a cascode r.f. amplifier followed by a pentode mixer with a triode oscillator in the same envelope. The coils are used to tune the r.f. grid, the r.f. anode, the mixer grid and the oscillator circuit. They are tuned by an assembly of iron dust and brass slugs, each set of coils being wound on its own tubular former. Channel selection is by push button. Other circuit details are fully described. The gain of the tuner is about 50 and the noise factor 4 - 6 dB.

H.G.M.Spratt

621.396.662

8208 CRYSTAL CODANS GIVE ACCURATE RECEIVER TUNING. R.L.Ives.

Electronics, Vol. 33, No. 22, 113 (May 27, 1960).

To eliminate inter-channel noise when tuning through a band, the first audio amplifier is biased off by a Zener diode in its cathode circuit. The i.f. signal is passed through a narrow-band crystal filter, rectified, smoothed and applied to the cathode circuit. Audio-frequency signals are applied to the grid.

W.C.Stripp

621.396.622

8209 SIGNAL-SEEKING AUTO RADIO USES SEMICONDUCTOR TUNING. J.G.Hammerslag.

Electronics, Vol. 33, No. 30, 60-3 (July 22, 1960).

The properties of the Si voltage-variable capacitors and their application in tuned circuits of radio receivers are discussed. In order to obtain highest Q and suitable capacitance, the controlling circuit is designed so as to give just the voltage variation required and large resistance is inserted between the controlling and controlled circuits. A circuit diagram of tuned states is given. Push-button tuning can be achieved by preset voltages, and signal-seeking by an RC network. An a.g.c. voltage is used to stop charging when a signal of sufficient strength is reached. Two diagrams of signal-seeking networks are given.

V.Bradić

621.396.662.4

8210 PARALLEL FIELD EXCITATION. V.Ianouchevsky.

Proc. Inst. Radio Engrs, Vol. 48, No. 6(I), 1165 (June, 1960).

The advantages of AT-cut piezo-electric quartz disks, excited by fields parallel to the major faces of the disks are outlined; these include higher Q, freedom from unwanted responses, and good frequency temperature characteristics. The devices are very similar to those described in Abstr. 4200 of 1960. With plated electrodes on the crystal surfaces, a disk has a fundamental frequency of 1 Mc/s and the Q is between 6 and 8×10^6. For non-plated crystals Q's of 20×10^6 have been obtained; this Q is dependent on the air gap and geometry of the external electrodes.

A.P.C.Thiele

AERIALS

621.396.67

8211 PATTERNS OF A RADIAL DIPOLE ON AN INFINITE CIRCULAR CYLINDER: NUMERICAL VALUES. C.A.Levis.

I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 2, 218-22 (March, 1960).

Describes a table which has been calculated for a short radial dipole mounted on the surface of an infinite cylinder, based on formulae derived in previous paper (see Abstr. 1246 of 1944). The table lists the radial electric field component when a plane wave is diffracted by the cylinder, without the stub, which enables the transmitting or receiving patterns of the stub to be calculated. The cylinder radii covered, range from 0.05λ to 0.50λ. A number of experimentally measured patterns for a finite cylinder 4 ft. long are compared with values calculated from the table at wavelengths of 12.7 and 6.35 cm., showing that the infinite cylinder gives a good approximation except for the fine lobe structure near the axis. Similar models of stubs on aircraft also show the table to give a useful first approximation.

G.D.Sims

621.396.67

8212 SYNTHESIS OF NONSEPARABLE TWO-DIMENSIONAL PATTERNS BY MEANS OF PLANAR ARRAYS. A.Ksienski.

I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 2, 224-5 (March, 1960).

It is shown that with a two-dimensional array of apertures, any desired radiation pattern, specified throughout the entire (Θ, ϕ)-space can be synthesized, regardless of whether the pattern is separable into two independent patterns in the principal planes or not. Such an array can thus be made to synthesise any Fourier series in two-dimensions.

G.D.Sims

621.396.67

8213 THE MUTUAL IMPEDANCE OF PERPENDICULAR HALF-WAVE ANTENNAS. D.R.Capps and D.L.Waidelich.

Proc. Nat. Electronics Conf., Vol. 15, 986-94 (1959).

The mutual impedance of two coupled linear aerials is needed to obtain the radiation impedance of an array of linear aerials and to determine the effect of one aerial upon a neighbouring aerial, for example, the effect of a transmitting aerial upon an adjacent receiving aerial. Much work has been done on two parallel half-wave aerials, but little quantitative data are available on skew aerials. This work is concerned with the mutual impedance of two half-wave aerials at right angles. The method employed in calculating the mutual impedance was that of Carter (Abstr. 2375 of 1932) and the resulting integrals were evaluated by an approximation method using a digital computer. The results are presented as curves in rectangular form for both the resistive and reactive components for the complex values of the mutual impedance. The curves indicate that the maximum coupling for two aerials at right angles occurs when the two aerials form an approximate L-shape.

621.396.67

8214 BEACON ANTENNAS FOR PROJECT MERCURY. D.F.Shea, D.Alstadter and W.O.Puro.

I.R.E. WESCON Convention Record, Vol. 4, Pt 1, 149-57 (1960).

Two sets of beacon aerials have been designed to operate in S and C bands. Each set of three flush aerials is arranged to radiate all round except for a 50° axial gap. Measured radiation patterns are given. The enviromental testing of the aerial is described.

W.T.Blackband

621.396.67 : 621.317.332.3

MEASUREMENT OF SPECIFIC EARTH RESISTANCE BY THE EQUIVALENT RESISTANCE METHOD. See Abstr. 7408

621.396.674.3

8215 BEHAVIOUR OF DIPOLE IMPEDANCES WITH TIME EXPONENTIAL EXCITATION OF DIPOLES. K.Fränz.

Arch. elekt. Übertragung, Vol. 14, No. 4, 167-8 (April, 1960). In German.

Variational methods of calculation cannot be used for radiation problems of aerials because both electric and magnetic energy of

the radiation field becomes infinite. Finite expressions for the energy can be, however, obtained when excitation increasing exponentially with time is considered. Power in the aerial becomes a minimum for the magnetic field satisfying Maxwell equations. Starting with this principle a relation is obtained between the impedance of the dipole and its size, and its dependence on the frequency. J.M.Silberstein

621.396.674.3

8216 A NOTE CONCERNING THE PRECISE MEASUREMENTS OF DIPOLE ANTENNA IMPEDANCE. S.Krevsky.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 3, 343-4 (May, 1960).

It is pointed out that it is often not easy to correlate a computed dipole input impedance with measurements (due among other things to ground effects etc.), however carefully they are made. It is suggested that calibration of the driving transmission line is worthwhile as inhomogeneities in it often account for one source of error. G.D.Sims

621.396.676

8217 THEORY AND PERFORMANCE OF VEHICULAR CENTER-FED WHIP ANTENNA. H.Brueckmann.
I.R.E. WESCON Convention Record, Vol. 4, Pt 7, 40-50 (1960).

The design considerations and results of extensive performance tests of a novel aerial for vehicular communication in the frequency range 30 to 76 M/s are given together with applicable theory. The principal features of the aerial include centre-feed through a coaxial cable, terminating it at its base into a variable reactor with different settings for each one of ten bands, providing separate built-in fixed-tuned matching networks for each band and switching them by means of automatic remote control which is activated by the frequency dial of the radio set. The design of the base reactor comprising a transmission line wound on a ferrite core having a tapped coil connected in parallel with it, and of the transmission line inside the whip are discussed in detail. Measured current distributions, radiation patterns, impedance plots and other performance data are presented.

621.396.677

8218 PREDICTING THE ANTENNA'S ROLE IN R.F.I. [RADIO-FREQUENCY INTERFERENCE]. E.Jacobs.
Electronic Industr., Vol. 19, No. 5, 96-102 (May, 1960).

Starts by outlining the general principles of aerial design in regard to beamwidth, sidelobe level and interference. Goes on to describe the different regions of operation for small and large radiators, and considers the aerial characteristics for far field space transmission and the Fresnel region. Finally considers the question of spurious frequency interference. A.C.Brown

621.396.677

8219 ANTENNA DESIGN FOR MAXIMUM L.F. RADIATION. G.J.Monser and W.D.Sabin.
Electronics, Vol. 33, No. 23, 84-6 (June 3, 1960).

A simplified analysis shows that for maximum radiation efficiency and specified bandwidth the ratio of the radiation resistance to the aerial reactance slope should be maximized. Experimental data supporting this theory is given for two base-feed radiators: a 1/10 scale model evaluated at 1.5 Mc/s and a 150 ft structure evaluated at 150 kc/s. The results are general and are applicable to the design of any electrically short vertical radiator. Z.F.Voyner

621.396.677

8220 BROADBAND LOG-PERIODIC ANTENNAS. R.L.Bell.
Electronics, Vol. 33, No. 25, 58-9 (June 17, 1960).

Tapered arrays based upon geometrical iteration have frequency bandwidths up to 10 : 1. These arrays are discussed in general terms, and radiation diagrams are given for two typical forms. W.T.Blackband

621.396.677

8221 A METHOD TO REDUCE ANTENNA GROUND REFLECTIONS. D.Sabih.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 2, 225-7 (March, 1960).

Describes a method for the elimination of ground reflections in aerial measurements. The signal driving the aerial under test is frequency-modulated and part of it is fed via a waveguide to the receiver. This signal beats with the incoming direct ray from the aerial and also with the unwanted ground-reflected ray. Because of the differences in propagation times for the three paths, and because of the sawtooth frequency sweep, the beat frequency for the direct ray will differ from that for the reflected ray which can be accordingly filtered out. Some typical figures are quoted for an X-band aerial example. G.D.Sims

621.396.677

8222 FRESNEL REGION BORESIGHT METHODS. A.J.Bogush, Jr.
I.R.E. WESCON Convention Record, Vol. 4, Pt 1, 139-48 (1960).

The task of "boresighting" a monopulse aerial in the Fresnel region of propagation is described with two approaches to the problem. In the first case a tower method is described with its limitations. Included is a discussion of a Fresnel region equation with a theoretical null-position variation with range shown along with measured results. The aperture distribution considered is the sum of a uniform and sinusoidal function. A second method entitled "auto collimation" boresighting is described which employs a boresighting screen positioned at ranges in the order of a reflector diameter. For the problem of field distribution behaviour, a different employment of the same basic equation is discussed. This method reduces the limitations of the Fresnel region equation at points close to the aperture. Computed and measured results of the auto collimation method are presented. The results including advantages and disadvantages of this technique are compared to the tower method.

621.396.677

8223 A NEW APPROACH TO ANTENNA BEAM SHAPING — THE "COKE-BOTTLE" ANTENNA. C.C.Phillips, Sr.
I.R.E. WESCON Convention Record, Vol. 4, Pt 1, 74-82 (1960).

Arrays in which all elements are fed in phase are easier to feed over a wide frequency range than those requiring feeds differing in phase. A method is described by which a type of Wullenweber array can be designed so as to give a desired radiation pattern with in-phase feed. In this the radiating elements are arranged in equispaced rings on a solid of revolution. Details are given of the design and performance of one such array which gives sharp cut-off at low angles of elevation and which can be fed for omniazimuthal or narrow beam radiation. W.T.Blackband

621.396.677

8224 DESIGN TECHNIQUES FOR A LIGHT WEIGHT HIGH POWER SPIRAL ANTENNA.
J.P.Jones, P.E.Taylor and C.W.Morrow.
I.R.E. WESCON Convention Record, Vol. 4, Pt 1, 107-22 (1960).

The operation of a spiral aerial is described in terms of the current band theory. A form of two-start Archimedian spiral wound from copper tube was embedded in various dielectric materials. The best power handling capacity was achieved for a combination of glass-loaded teflon near the feed point with a foamed dielectric for the outer parts. Information is given about the matching devices, cavities and radomes used together with the achieved radiation patterns and v.s.w.r. plots. A bibliography of papers published on spiral aerials in U.S. is included. W.T.Blackband

621.393.677

8225 DETERMINATION OF THE OPTIMUM ANTENNA PATTERN FOR A SIGNAL BURST COMMUNICATION SYSTEM. P.A.Lux, H.M.Swarm and D.D.McNelis.
I.R.E. WESCON Convention Record, Vol.4, Pt 7, 17-26 (1960).

Deals with finding the optimum directivity pattern of an aerial which is used as part of a communication system. Due to irregularities in the atmosphere, ionosphere, or meteor trails, a signal does not arrive at the receiving aerial from one direction only. Therefore the highest possible gain aerial with its narrow beamwidth is not always optimum for point-to-point communications. It is found that the optimum directivity pattern is determined by the probability distribution of the angle of arriving signal, the attenuation of the signal by the propagating medium, and the receiving criteria. Only single-path propagation is assumed at any instant. The results are most readily adaptable to a meteor-burst communication system, but extensions to other single-path propagation systems should not be too difficult.

621.396.677

8226 EFFECTS OF TOWER AND GUYS ON PERFORMANCE OF SIDE-MOUNTED VERTICAL ANTENNAS.
R.F.H.Yang and F.R.Willis.
I.R.E. WESCON Convention Record, Vol. 4, Pt 7, 54-61 (1960).

The omnidirectional pattern of a vertical aerial when side-mounted on a mast or tower is distorted as a function of tower diameter and separation in wavelength. The pattern is further effected by obstruction of metallic tower guys. Laboratory and field measurements of these effects are analysed. Possibility of taking advantage of these effects for special coverage is suggested. Tower effect on aerial impedance is briefly discussed.

621.396.677 : 523.16

8227 THE SYNTHESIS OF LARGE RADIO TELESCOPES. M.Ryle and A.Hewish.
Monthly Not. Roy. Astron. Soc., Vol. 120, No. 3, 220-30 (1960).

Many investigations in radio astronomy are limited by the resolving power which can be achieved by conventional methods of aerial construction. A new method of obtaining increased resolving power has been developed, which has been applied to the construction of both "pencil-beam" systems and interferometers. In this method two aerials are arranged so that their relative position may be altered to occupy successively the whole area of a much larger equivalent aerial. By combining mathematically the information derived from these different positions, it is possible to obtain a resolving power equal to that of the large equivalent aerial. Since the combination of the individual records may be done with different phase relationships, it is possible, without extra observations, to "scan" the synthesized aerial over an appreciable solid angle; because of this the total observing time of a synthesized instrument is of the same order as that of a conventional instrument. An interferometric system designed for the study of radio stars has been built which has an equivalent area for resolution of 8×10^5 ft^2 as well as a "pencil-beam" system with an equivalent area of 3×10^4 ft^2. The sensitivity of both systems corresponds to a "collecting area" of about 2×10^5 ft^2.

621.396.677

8228 RESPONSE OF A SQUARE APERTURE TO A THERMAL POINT SOURCE OF RADIATION. M.S.Wheeler.
Proc. Inst. Radio Engrs, Vol. 48, No. 6, (I), 1170-1 (June, 1960).

The response of an aerial to black-body radiation depends not only upon the radiation pattern at the mid-frequency but upon the frequency bandwidth. Expressions are derived for the response of a square aperture, and curves are given for bandwidths which are infinite, one octave, 10% or 1%. With increasing bandwidth the beamwidth increases slightly and the sidelobe level is decreased.
W.T.Blackband

621.396.677

8229 APERTURE ANTENNA SYNTHESIS AND INTEGRAL EQUATIONS. A.Ishimaru.
Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1344-5 (July, 1960).

The determination of the primary source of illumination for an aperture in order to produce a desired radiation pattern leads to the problem of a Fredholm equation of the first kind with a finite range of integration. The exact solution of the integral equation is extremely difficult. Using the results of recent investigations on the aperture aerial synthesis a method is presented enabling problems of this type to be solved.
Z.F.Voyner

621.396.677

8230 FERRITE RODS FOR BROADCAST RECEIVER ANTENNA COILS. C.M.Wright.
Proc. Instn. Radio Engrs Australia, Vol. 21, No. 6, 410-12 (June, 1960).

Equations are presented for the design of aerial coils wound on ferrite rods.

621.396.677 : 681.142

8231 FAR FIELD ANTENNA PATTERN CALCULATIONS BY MEANS OF A GENERAL PURPOSE ANALOG COMPUTER. A.I.Rubin, J.P.Landauer and H.Q.Totten.
Proc. Nat. Electronics Conf., Vol. 15, 995-1011 (1959).

The complexity of aerial pattern calculations has, in the past, necessitated the use of the highest speed and largest capacity digital computers, such as the I.B.M. 704. The core of the problem is the evaluation of a surface integral of a complex, vector integrand of the form

$$E(\theta,\phi) = \iint f(x,y,z)\, \exp\{-jg(x,y,\theta,\phi)\}\, dS$$

where E is a complex vector, f is an ordinary vector dependent on the horn pattern and the geometry of the aerial surface, and g is a scalar measure of the path length of a ray travelling from the horn, to the reflector and thence to the aperture plane through the focus. The particular "far field point" is defined by coordinates θ,ϕ. dS is the differential of the aerial surface. To determine the feasibility of carrying out these calculations on an analogue computer, the particular case of a circular paraboloid aerial surface was chosen. Both on-axis and off-axis horn locations were evaluated for far field points in the principal θ,ϕ planes. The analogue computer programmes are shown in detail and means of improving efficiency are discussed. It is concluded that the analogue computer can successfully compete with the I.B.M. 704 computer in this general problem area, with a possibility of a cost reduction factor of from three to ten.

621.396.677 : 621.396.96

8232 DESIGN OF A SPECIAL-SHAPE AERIAL FOR SCANNING RADAR. J.Musil and L.Obruča.
Slaboproudy Obzor, Vol. 21, No. 8, 484-90 (1960). In Czech.

The aerial considered consists of a double-curvature reflector formed by the envelope of a system of parabolas and a horn-type radiator. The aerial is required to produce a narrow beam in azimuth and a "cosec^2" beam in bearing. The cross-section of the reflector, by the symmetry plane $y = 0$ generates a characteristic curve C which is the most important element in the design of the system. By a suitable choice of C it is possible to secure the required vertical radiation pattern and determine the area of the reflector. A formula for C is derived. This is in the form of an integral equation which can be solved by the method of successive approximations. Alternatively, it can be solved by an analytical-experimental method, whereby C is first approximated analytically. A model is then constructed and its radiation pattern is determined. The measurements on the model permit the evaluation of a correction equation. The procedure can be repeated several times. Both methods are explained in some detail and some experimental results are given.
R.S.Sidorowicz.

621.396.677

8233 RADAR AERIALS AND SCANNERS. H.U.Klauser.
Scientia Electrica, Vol. 6, No. 2, 53-74 (June, 1960).

A survey is given for the wide field of microwave aerials, and in particular of applications in radar. Fundamental problems in the technique of directive aerials, scanners and equipment are discussed and finally some aerial system are considered.

621.396.677

8234 METHODS OF MEASUREMENT IN RADIOASTRONOMY. H.G.Müller.
Z. InstrumKde, Vol. 68, No. 6, 117-24 (June, 1960). In German.

621.396.677.012.71

8235 ANTENNA PATTERNS FROM THE SUN. D.W.Bray and P.H.Kirchner.
Q.S.T., Vol. 44, No. 7, 11-15 (July, 1960).

Gives an approximate method of plotting vertical radiation patterns by using the sun as a source of radio noise. The sun is tracked in azimuth over a period around sunrise or sunset. The sun's elevation is determined from latitude, date and formulae given. Before each reading of noise output, a resistor equal to the impedance of the transmission line is substituted for the aerial, and its output is noted. Received noise outputs are referred to the resistor outputs.
W.G.Stripp

621.396.677.3

8236 THE POWER GAIN OF MULTI-TIERED V.H.F. TRANSMITTING AERIALS.
P.Knight and G.D.Monteath.
B.B.C. Engng Monogr., No. 31, 5-38 (July, 1960).

Transmitting aerials for v.h.f. broadcasting usually consist of a number of similar groups or tiers of radiating element, spaced at intervals along a supporting mast. The power gain of such an arrangement depends on the number of tiers, on the spacing between them, and also on the vertical radiation pattern on each individual tier. A method of calculating the gain is described. Results computed for a comprehensive range of variables are presented in the form of tables.

621.396.677.3

8237 PLANE AERIAL WITH PERIODICALLY BENT [ZIG-ZAG] CONDUCTOR. G.v.Trentini.
Frequenz, Vol. 14, No. 7, 239-43 (July, 1960). In German.

Examines the radiation characteristics of a periodically bent (zig-zag) conductor placed in a plane $\lambda/10$ approx. in front of a reflector. The conductor acts as a feeder and as an aerial; when sufficiently long, it carries an almost progressive radiation-damped wave. The radiation pattern is highly directional but the direction of the main beam varies with frequency when the aerial is end-fed. Constant transversal radiation is obtained over a relative bandwidth of about 6% by a symmetrical structure where the centre of the zig-zag aerial is connected to the inner, and the the reflector to the outer of the coaxial feeder. The theory was verified on X-band models. Z.F.Voyner

621.396.677.3

8238 APPLICATION OF FREQUENCY SCAN TO CIRCULAR ARRAYS. P.Shelton.
I.R.E. WESCON Convention Record, Vol. 4, Pt 1, 83-94 (1960).

The problem of obtaining focusing from a circular array together with 360 degree scanning by frequency variation is considered. It is shown that uniform variation of the line length between elements of a tapped serpentine transmission line allows good focusing from a circular array. The radiating aperture is limited to the appropriate sector of the circle by using filters in the coupling junctions between the serpentine line and the radiating elements. The relation between bandwidth and transmission-line folding factor is determined, and limitations imposed by element coupling, element spacing, and overlapping apertures at the band edges are found. Accuracy of focus is determined as a fourth-power function of aperture size relative to diameter. Aperture amplitude distribution is related to the filter characteristics and efficiency of coupling. The design of directional filters for partial coupling is described, and the effect of the transfer phase characteristic is calculated. Performance is estimated for a sample design covering the frequency range 2 to 4 Gc/s with a six-foot-diameter array of 100 elements.

621.396.677.3

8239 AN OMNIDIRECTIONAL CIRCULAR ANTENNA ARRAY EXCITED PARASITICALLY BY A CENTRAL DRIVEN ELEMENT. H.P.Neff and J.D.Tillman.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 190-2 (1960) = Commun. and Electronics, No. 48 (May, 1960).

A central dipole or unipole is surrounded by a ring of parasitic elements. This system radiates equally in all directions in the plane of the ring, but has a minimum in radiated signal at an angle to this plane. For a ring radius of about 0.4λ this minimum is very deep. By varying the length of the parasites or adjusting a terminating reactance in each parasite it is possible to control the direction of the minimum. Theoretical performace curves are given, and it is shown that these agree well with the experimental data. Such arrays have application to medium wave broadcast transmission. W.T.Blackband

621.396.677.3

8240 PHASE CENTER DISTRIBUTIONS OF SPIRAL ANTENNAS. N.Barbano.
I.R.E. WESCON Convention Record, Vol. 4, Pt 1, 123-30 (1960).

The phase-centre distributions of four types of equiangular spiral aerial were experimentally determined at a frequency of 3.0 Gc/s to enhance the general knowledge of these types of frequency-independent aerial. The usual methods available for determining phase centres were considered. The two-probe method for examining the far field wavefront was used. A new type of probe aerial was developed that is capable of being made very inexpensively for either horizontal or vertical polarization.

621.396.677.3 : 551.5

8241 A HIGHLY DIRECTIVE ROTATING ARRAY FOR 16 Mc/s ARRAY. J.A.Thomas and R.W.E.McNicol.
Nature (London), Vol. 187, 398-9 July 30, 1960).

A brief description of an aerial system for studying field-aligned ionization in the F-region of the ionosphere. The effective half-power beam width is 8° and the speed of rotation is one revolution per 3 mins. C.Hazard

621.396.677.3

8242 A NEW MATHEMATICAL APPROACH FOR LINEAR ARRAY ANALYSIS. D.K.Cheng and M.T.Ma.
Proc. Nat. Electronics Conf., Vol. 15, 977-85 (1959).

It is well known that linear arrays are representable mathematically by polynomials. However, even for the simplest case of a uniform array, properties of its radiation pattern are conventionally analysed by examining the transcendental form of the array factor and some of its important characteristics have been determined only approximately. For a more general array, a closed form of the associated polynomial is usually not obtained and the analysis becomes quite difficult. A new approach for linear array analysis is proposed. Basically, the current distribution in the discrete elements of a linear array is considered as the sampled values of a continuous function. Known relations in Z transforms developed for sampled-data system can then be used to express the array polynomial in a closed form. Mathemetical techniques for determining important properties of the array pattern are developed. Typical examples illustrating the applications of this new approach are given.

621.396.677.31

8243 A LOW SIDELOBE INTERFEROMETER ANTENNA. J.A.Kuecken and H.L.Pfizenmayer.
I.R.E. WESCON Convention Record, Vol. 4, Pt 1, 95-106 (1960).

An investigation into a series of interferometer aperture distributions is presented. Calculated and measured patterns for small 8-element and large 36- and 60-element arrays are shown with the effects of distribution shape discussed. Some distributions capable of producing interferometer patterns with sidelobes below −20 dB are described.

621.396.677.33

8244 A BROADBAND 160-MC COLINEAR ARRAY. R.F.H.Yang and L.H.Hansen.
I.R.E. WESCON Convention Record, Vol. 4, Pt 7, 51-3 (1960).

The design of a 3-element colinear array is described. Over the 152-162 Mc/s band, the array has a minimum gain of 4 dB over a half-wave length dipole and v.s.w.r. less than 1.5. The circularity of its horizontal pattern is ±0.25 dB. The array elements are covered and supported by a fibre glass tube. D.C. grounds are provided for these radiating elements for lightning protection and reduction in static noise.

621.396.677.71

8245 MINIATURIZED CAVITY-FED SLOT ANTENNAS. F.P.Brownell, Jr and D.E.Kendall.
I.R.E. WESCON Convention Record, Vol. 4, Pt 1, 156-66 (1960).

Describes the design and operating characteristics of miniaturized cavity-fed slot aerials for use at v.h.f. Miniaturized aerials leads to severe problems in impedance matching and radiation pattern control, and requires special techniques in order to maximize bandwidth. Furthermore, consideration must be given to the variation in dielectric constant with temperature for various materials used for cavity loading.

621.396.677.71

8246 THE EFFECTS OF ERRORS ON THE POLAR DIAGRAM OF A SLOT ARRAY. D.S.Palmer.
Marconi Rev., Vol. 23, 110-14 (3rd Qtr, 1960).

Algebraic expressions are given for the correlation between the errors in the field from a slotted waveguide as measured in two directions, in terms of the random errors in field strength and phase which are assumed to be introduced at each slot. Comparison with DEUCE computations incorporating random phase errors shows close agreement. Extensions to a dish subject to error, and to a two-dimensional array of radiating elements, are mentioned in general terms.

621.396.677.71 : 621.371

8247 PROPAGATION OF AN ELECTROMAGNETIC WAVE ALONG THE SLOT IN A CYLINDRICAL SURFACE. P.Szulkin.
Arch. electrotech. (Warsaw), Vol. 8, No. 3, 355-67 (1959). In Polish.

The mode theory of propagation of e.m. waves for slot aerials is examined. The independence of distribution of TE and TM modes is proved and the field equations are derived by the introduction of the corresponding Green function. The propagation constant is

determined by the variational method, the accuracy of which is sufficiently close even when the field distribution along the slot is known only approximately. Z.F.Voyner

621.396.677.71

8248 A COMPACT DUAL-BEAM S-BAND BEACON ANTENNA. G.G.Chadwick and R.M.Phillips.
Proc. Nat. Electronics Conf., Vol. 15, 965-76 (1959).

A flush-mounted strip transmission-line array is discussed which is capable of providing dual endfire beams with the radiation pattern maxima lying along the surface of the radiator. The radiating surface is formed of an array of closely spaced non-resonant series transverse slots which are protected from the external environment by a dielectric cover. High directivity is obtained by feeding each end of the radiation structure, thus utilizing the entire aperture for each endfire beam. The aerial is extremely compact and capable of performing over bandwidths in excess of 1.5 to 1.

621.396.677.8

8249 CHECKING DESIGN OF STEPPED LUNEBERG LENS. H.F.Mathis.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 3, 342-3 (May, 1960).

Outlines a checking procedure based on geometrical optics using Snell's law and ignoring reflections. Formulae are derived relating the co-ordinates of an arbitrary emergent ray, at the focal radius, to the parameters of the lens. These may be used to determine rapidly how well any design of lens meets the required focusing specification. G.D.Sims

621.396.677.8

8250 AN INVESTIGATION OF THE FEASIBILITY OF OBTAINING A CONSTANT BEAMWIDTH LUNEBERG LENS. L.K.De Size and B.A.Woodward.
Proc. Nat. Electronics Conf., Vol. 15, 958-64 (1959).

An investigation was conducted to determine the feasibility of obtaining a constant-beam width Luneberg lens for direction-finding applications. A modified Luneberg lens was derived that produces spherical phase fronts. These phase fronts, in conjunction with a controlled amplitude distribution in the lens aperture, give radiation patterns having a half-power beam width variation of less than ± 10% of the design beamwidth over a 3 : 1 frequency band. An experimental two-dimensional model of a modified Luneberg lens was built, and the theoretical phase front verified by measurement of the phase front across the lens aperture.

621.396.677.83

8251 A GAS DISCHARGE BURNING IN FREE SPACE AT THE FOCAL POINT OF A RADAR PARABOLOID. J.Geerk and H.Kleinwachter.
Z. Phys., Vol. 159, No. 4, 378-83 (1960). In German.

Experiments were carried out to check the validity of Airy's formula for the diffraction cross-section of a converging beam from a paraboloidal reflector. A pulse-modulated 40 kW 3 cm transmitter was used with a magnetic dipole which could be moved along the axis. A movable detector was used to plot the field intensity. With this simple arrangement it was not possible to obtain sufficient field strength to produce a discharge. Further experiments were carried out with two reflectors facing each other, with the gas discharge taking place in a glass vessel in which the pressure was variable. The field strength in the discharge region was calculated from Airy's formula to be 1 kV/cm, which was found to be in good agreement with the breakdown field strength in a gas discharge between two electrodes. W.G.Stripp

621.396.677.833.1

8252 ON THE BEAM DEVIATION FACTOR OF A PARABOLIC REFLECTOR. Y.T.Lo.
I.R.E. Trans Antennas and Propagation, Vol. AP-8, No. 3, 347-9 (May, 1960).

Scanning can be achieved with a fixed parabolic reflector by physically displacing the feed in the focal plane. The beam deviation factor is defined as the ratio of beam deflection angle to angular displacement of feed, both angles being measured from the axis with the vertex as origin. An expression for the factor is derived and experimental and calculated curves of beam deviation factor as a function of the reflector parameters are given. G.D.Sims

621.396.677.833.1 : 538.56

8253 THE RECEIVED POWER PATTERNS DUE TO MICRO-WAVE PARABOLOIDAL REFLECTOR. K.K.Dey and A.P.Kulshreshtha.
J. sci. industr. Res., Vol. 19B, No. 9, 325-9 (Sept., 1960).

A detailed mathematical theory is developed for the calculation of power patterns in the Fresnel and quasi-Fraunhofer regions for a microwave paraboloidal reflector with a dipole source at its focus. Two different methods for evaluating the integral in the expression for received power are described. The theory was experimentally verified for a simplified case of the power received along the axis of the paraboloid in the Fresnel and quasi-Fraunhofer regions.

621.396.677.833.1

8254 PARABOLOIDAL REFLECTORS WITH AXIAL EXCITATION. A.R.Donaldson, I.P.French and D.Midgley.
Proc. Instn Elect. Engrs, Paper 3311E, publ. Nov., 1960 (Vol. 107B, 547-52).

The reflectors are deep paraboloids having axially oriented dipoles at the foci. Odd-function aperture distributions and radiation patterns are derived by approximate methods and are compared with an experimental polar diagram. In spite of a null along the axis, strong coupling at short range is observed between two aligned aerials. This is associated with a coupling diagram of abnormal directivity, which may be explained by a principle of field-fitting between the incident field and the normal aperture distribution. A reduction of Maxwell's equations in paraboloidal co-ordinates to Bessel's equation is appended.

621.396.679.4

8255 HIGH-POWER FEEDER LINES FOR DECIMETRE AERIALS. H.Laub and W.Stöhr.
Frequenz, Vol. 14, No. 4, 142-55 (April, 1960). In German.

A number of microwave components of the type used in feeder systems are described. Various types of feeder such as coaxial, hollow-waveguide and single-wire transmission lines are discussed with particular reference to the effects of attenuation and small reflections on transmission properties. A.E.Karbowiak

PROPAGATION . INTERFERENCE

621.391.8

8256 GRAPHICAL METHOD OF CALCULATION OF THE COEFFICIENTS OF REFLECTION FROM THE SURFACE OF THE EARTH. P.Szulkin.
Arch. elektrotech. (Warsaw), Vol. 8, No. 1, 97-102 (1959). In Polish.

The complex values of coefficients of reflection from the surface of the earth are determined graphically for either vertical or horizontal polarization of electromagnetic waves. This graphical method is based on some permissible simplifying assumptions and obviates laborious calculations. Short summaries in Russian and English are given. A.Woroncow

621.391.8

8257 THE EFFECT OF TRANSMISSION LINES ON THE GROUND FIELD OF A RADIO WAVE. V.N.Krasil'nikov.
Radiotekhnika, Vol. 15, No. 7, 3-9 (July, 1960). In Russian.

Considers the idealized problem of the diffraction by a straight cylindrical conductor of radius a at height h above a plane homogeneous earth (z = 0 plane) of the field from a dipole (wavelength λ) at the origin, where $a \ll h \ll \lambda$. This is of practical interest for m.w. radio navigation systems. The part of the line distant from the origin leads to a substantial phase shift if $\lambda < 1000$ m. D.E.Brown

621.391.812.3

8258 ERROR PROBABILITIES FOR TELEGRAPH SIGNALS TRANSMITTED ON A FADING F.M. CARRIER. B.B.Barrow.
Proc. Inst. Radio Engrs, Vol. 48, No. 9, 1613-29 (Sept., 1960).

Presents an analysis of error probabilities for multiplexed binary telegraph signals that are used to frequency-modulate an r.f. carrier that is subsequently corrupted by fading and noise. Frequency-shift keying, amplitude keying, and phase-shift keying are

considered. It is shown that most telegraph errors occur when the carrier fades below threshold, and the principal results of the study therefore concern the effects of the f.m. threshold on error rate. Various methods of diversity reception are considered. For a maximal-ratio baseband combiner and certain types of telegraph receiver, a method is given for extending the results obtained for a single receiver to nth-order diversity. This makes it possible to use experimental data to describe either the threshold or the fading of the carrier. Study of threshold models indicates a serious conflict between the requirements of telephone channels and those of telegraph channels. Furthermore, good telegraph performance demands great care in the design of diversity combiners to work below threshold. The analysis pertains most directly to troposcatter systems, but the general conclusions regarding the effect of f.m. threshold should be relevant also for fading transmission paths such as those met in line-of-sight and telemetry.

621.391.812.31

8259 SOME COMPUTATIONS OF ERROR RATES FOR SELECTIVELY FADING MULTIPATH CHANNELS.

G.L.Turin.

Proc. Nat. Electronics Conf., Vol. 15, 431-40 (1959).

The probability that an ideal receiver makes an error in receiving a binary transmission through a noisy, selectively fading, discrete-multipath channel can often be related to the probability that the difference of two quadratic forms is complex normal variables, in itself a quadratic form, in less than a given constant. An expression for this error probability is presented and conditions are discussed under which this expression may be easily evaluated. Two particular cases are analysed and compared in detail. The first is the limiting case in which the paths have no non-random components, and fade independently. The second is the opposite limit in which the paths have no random components. Results are presented which illustrate the dependence of the error probability in these cases on the number of paths and their relative strengths.

621.391.812.32

8260 RAPID PERIODIC FADING OF MEDIUM WAVE SIGNALS. H.Misra.

Proc. Inst. Radio Engrs, Vol. 48, No. 6(I), 1167-8 (June, 1960).

Yeh and Villard reported the occurrence of rapid fading of signals in the 41 m band propagated over long paths crossing the magnetic equator (Abstr. 2507 of 1959). The same type of rapid fading has now been observed with signals in both the s.w. and m.w. bands. Typical records of such fading in the 19 m and 61 m bands and at 280.4 m wavelength, all obtained on the same day, and similar fading records of 280.4 m signals on two other days, are shown. The rate of fading of the m.w. signals was of the same order as that of the s.w. signals. Further records are being made. A.Wilkinson

621.391.812.42 : 551.5

8261 ANOMALOUS WINTER ABSORPTION OF RADIO WAVES. R.W.Morriss.

Proc. Phys. Soc., Vol. 75, Pt 6, 937-9 (June, 1960).

Measurements of the absorption of cosmic noise at a frequency of 24.3 Mc/s were made over the period January, 1957 to May, 1958. The average midday absorption in winter was found to be about twice as great as that in summer. This winter measurement conflicts with measurements of absorption made at 3 Mc/s if it is assumed in both cases that $\nu^2 \ll (\omega + \omega_s)^2$ where ν is the electron collisional frequency and ω the frequency of observation. It is therefore concluded that the above expression is not valid at the lower frequency on most days in winter. This implies that on these days the absorbing electrons are largely concentrated near the level where $\nu \simeq 2.6 \times 10^{-7}$ sec^{-1} which is at a height of about 60 km.

C.Hazard

621.391.812.6

8262 SOME MEDIUM FREQUENCY SKY WAVE MEASUREMENTS. J.M.Dixon.

Proc. Instn Radio Engrs Australia, Vol. 21, No. 6, 407-9 (June, 1960).

Sky-wave field-strength measurements at broadcast frequencies for distances up to 2000 miles are reported for the period 1953-1958. Correlation of the field strength with sunspot number and E-layer critical frequency is discussed.

621.391.812.61 : 621.373.44

ARTIFICIAL PRODUCTION OF LIGHTNING ATMOSPHERICS.

See Abstr. 7722

621.391.812.62

8263 PARTIAL REFLECTIONS IN THE ATMOSPHERE AND LONG DISTANCE PROPAGATION. V. TROPOSPHERIC REFLECTION AND DIFFUSION OF RADIO WAVES. J.Voge.

Ann. Telecomm., Vol. 15, No. 5-6, 107-21 (May-June, 1960). In French.

See Abstrs. 3816-17, 6108 of 1959; 3121-2 of 1960. The power received at the end of the propagation path for the cases of diffuse and specular reflection from a single "feuillet" or from an extended layer in the atmosphere is determined. Long-distance propagation characteristics arising from this kind of propagation are compared with those arising from turbulent diffusion and it is shown that in the majority of cases diffuse reflection is locally much more important than turbulent diffusion, the latter being more characteristic of the atmosphere in extenso. The various suggested propagation mechanisms are compared with reference to the variation of the received field with distance and frequency (insofar as this determines the fine structure of the received signal), diversity distances, transmission bandwidths, and rapid fluctuations in received signal. The instantaneous characteristics of the received signal frequently show the influence of reflections from discrete "feuillets" rather than the characteristics of turbulent diffusion.

G.D.Sims

621.391.812.62

8264 PARTIAL REFLECTIONS IN THE ATMOSPHERE AND LONG DISTANCE PROPAGATION. VI. THE DIFFERENT COMPONENTS OF THE FIELD BEYOND THE HORIZON. A.Spizzichino.

Ann. Telecomm., Vol. 15, No. 5-6, 122-36 (May-June, 1960). In French.

See preceding abstract. The results of an earlier paper on reflection from irregular surfaces are applied to the estimation of tropospheric reflection phenomena. A comparison of these results with those of classical diffusion theory shows marked differences and the characteristics of the fluctuations of the received field allow the type of mechanism operating to be easily identified. The field beyond the horizon sometimes exhibits the qualities associated with reflection and sometimes those of diffusion. The consequences of the co-existance of the two propagation mechanisms are discussed. G.D.Sims

621.391.812.62

8265 PARTIAL REFLECTIONS IN THE ATMOSPHERE AND LONG DISTANCE PROPAGATION. VII. NOTE ON TROPOSPHERIC PROPAGATION PHENOMENA. F.du Castel.

Ann. Telecomm., Vol. 15, No. 5-6, 137-42 (May-June, 1960). In French.

See preceding abstracts. A further study of reflection by irregular surfaces in the atmosphere. The earlier results of Spizzichino and Voge are compared and a new approach to the problem based on spectral analysis enables the differences and similarities of the former theories to be assessed. G.D.Sims

621.391.812.62

8266 TROPOSPHERIC PROPAGATION AT V.H.F. J.M.Dixon.

Proc. Instn Radio Engrs Australia, Vol. 21, No. 6, 398-406 (June, 1960).

An analysis of v.h.f. field-strength recordings for propagation beyond the horizon is presented. The study results from measurements made to establish the interference field strength between common-channel television transmitters when the propagation path is over undulating country without mountain ranges. The received field strength is shown to be greater in Band I than in Band II for points well beyond the horizon. There is a marked dependency of field strength and fading rate on meteorological conditions up to an altitude of about 6000 ft. When tropospheric layers (dn/dh greater than normal) occur, there is a simultaneous decrease in the fading rate and an increase in field strength. The effect of layer thickness, layer height and rate of change of dielectric constant through the layer is shown. Under standard atmospheric conditions the received field strength is found to agree well with that calculated for diffraction around the earth and reflection from the troposphere. The average observed field strength exceeded for 10% of the time during winter at points well beyond the horizon is found to agree with values extracted from F.C.C. and C.C.I.R. curves, but large discrepancies occur in the case of field strength values exceeded for 50% of the time.

621.391.812.624

8267 **PROPAGATION MEASUREMENTS AT 3480 AND 9640 Mc/s BEYOND THE RADIO HORIZON.**

G.V.Geiger, N.D.La Frenais and W.J.Lucas.
Proc. Instn Elect. Engrs, Paper 3319E, publ. Nov., 1960 (Vol. 107B, 531-46).

Gives an account of scatter-propagation measurements made at S- and X-band during the period May, 1957 to May, 1959. The work at S-band continued throughout the whole of this time, while the X-band measurements were made during the period of a year from June, 1958 to May, 1959. The S-band transmitter, using a 3.480 Gc/s c.w. magnetron with a power output of 500 watts, was established at Start Point in Devon. Receiving terminals were set up at Wembley, Middlesex, and Witnesham, Suffolk, at distances of 173 and 247 statute miles, respectively, from the transmitter, the former being maintained in operation throughout the whole of the experimental period and the latter for a period of nine months from September, 1957 to June, 1958. Diurnal and seasonal variations in the median level of the received signal are discussed and a comparison is made of measurements taken simultaneously at Wembley and Witnesham. The distribution of the S-band fading rate as a function of level is studied and a limited amount of work concerned with the distribution of the duration of fades below a given level and the power spectrum of the detected signal is described. The transmission path for the X-band system, which used a pulsed magnetron at a frequency of 9.640 Gc/s, also lies between Start Point and Wembley; the pulse length was 2 microsec and the pulse-repetition frequency 500 c/s, the peak power in the pulses being 180 kW. The X- and S-band links were operated together whenever possible, and a comparison is made of the median level and fading rate of the signals received simultaneously at the two frequencies over the same propagation path. In addition, a series of measurements to investigate the aerial coupling loss of the X-band system are described.

621.391.812.63

8268 **CONTRIBUTION TO THE STUDY OF IONOSPHERIC ABSORPTION AT A FIXED FREQUENCY.** G.Pillet, Ann. Telecomm., Vol. 15, No. 7-8, 157-84 (July-Aug., 1960). In French.

Describes an extensive programme of measurements of ionospheric absorption, conducted with the aid of a pulsed transmitter at 3.4 Mc/s, under conditions of vertical incidence. The apparatus includes a discriminator which eliminates the extraordinary wave and the absorption is estimated by comparing the amplitude of the echoes received with the amplitude of received signal which would be expected if the atmosphere were non-absorbing and the signal was considered to be reflected at the standard height. The absorption observed is found to vary irregularly by amounts of several dB, from one quarter-hour to the next while, similarly, curves showing the absorption at a given hour of the day show a strong dispersion of values throughout the year. The nett mean monthly absorption is stronger in summer than in winter and increases with solar activity. The seasonal variation in absorption for a constant value of zenithal angle shows an anomaly in that the absorption is stronger in winter than in summer. G.D.Sims

621.391.812.63

8269 **AN IMPROVED AUTOMATIC METHOD FOR MEASUREMENT OF IONOSPHERIC ABSORPTION.**

L.Thomas.
Electronic Engng, Vol. 32, 635-9 (Oct., 1960).

Ionospheric absorption has been measured at University College of Swansea by an automatic method during the I.G.Y. The equipment described is an improvement of an earlier model recording the mean echo amplitude over an interval of about one minute. The whole system is synchronized to one pulse per second trigger voltages thus providing improved compensation for background noise signals and the minimum interference with other services. The general performance of the equipment is discussed and a comparison made between automatic measurements and those made by the standard manual method.

621.391.812.63

8270 **SIGNAL TRANSMISSION THROUGH IONISED MEDIA.** W.A.Greenhow.
Electronics, Vol. 33, No. 21, 81-5 (May 20, 1960).

A general account is given of the various mechanisms of ionization and of the ways in which ions are lost by attachment or recombination. The relative importance of these factors is discussed for the cases of rocket flames, nuclear explosions and re-entry from space. Graphs and tabulated data are given from which attenuation and reflection losses can be assessed. W.T.Blackband

621.391.812.63 : 538.56

8271 **THE FADING OF LOW-FREQUENCY RADIO WAVES REFLECTED FROM THE IONOSPHERE.** W.A.Cilliers. J. atmos. terrest. Phys., Vol. 19, No. 2, 102-14 (Oct., 1960).

A study has been made of the fading of radio waves of frequency 70-200 kc/s reflected at steep incidence from the ionosphere. It is shown that the amplitude fading on 113 kc/s is sufficiently consistent to be represented by an average correlogram. Some measurements of the complex amplitude are reported and the correlograms deduced from them are compared with those derived from measurements of real amplitude. On all frequencies there is a component of fading with a correlation time (to e^{-1}) of order 90 sec corresponding to a fading period of order 7.5 min and there is some evidence that this component of the fading is quasi-periodic. This quasi-periodic component is noticeable on a cross correlogram relating measurements made simultaneously on waves of quite different frequencies, from which it is deduced that it is caused by a quasi-sinusoidal irregularity in the ionosphere, which affects all the frequencies. Observations at three spaced receivers show that these irregularities have a spatial period of order 20 km and that they travel with speeds of about 35 m sec^{-1}. This drift of the irregularities is an important cause of the fading. On the higher frequencies there is clear evidence of a more rapid component of fading with a correlation time of the order 50 sec.

621.391.812.63 : 538.56

8272 **THE PROPAGATION OF FADING WAVES.** R.P.Mercier.
Phil. Mag. (Eighth Ser.), Vol. 4, 763-76 (June, 1959).

A scalar wave with random variations of amplitude and phase across the wave-front is assumed as a simple model of a radio wave after it has left the ionosphere. The second-order moments of the in-phase and quadrature components of the fluctuating part of the field are found using the Fresnel diffraction formula. It is assumed that these two components have a joint Gaussian distribution, and a parameter ρ_N, called the intrinsic correlation of the fading, is introduced; this serves as a measure of the eccentricity of the ellipse of constant probability. It is shown that ρ_N is the amplitude of the diffraction pattern produced by a distribution of intensity proportional to the spatial correlation function of the fluctuations over the wave-front. As the wave propagates the correlation tends to zero. It is shown that for a given irregularity size and wavelength, the irregularities may be supposed to be situated at any height, up to a certain maximum height, at which $\rho_N = 1$. An analysis of day time fading on 16 kc/s was made. It appears that the intrinsic correlation of the wave at the ionosphere is very near one, and that the ionosphere imposes phase modulation on the wave.

621.391.812.63

8273 **INFLUENCE OF SOURCE DISTANCE ON THE IMPEDANCE CHARACTERISTICS OF E.L.F. RADIO WAVES.** J.R.Wait.
Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1338-9 (July, 1960).

Quantitative results for the wave impedance at extremely low frequencies (e.l.f.) are presented for the case of a flat perfectly conducting earth and a plane ionospheric reflecting layer at height h. The source is assumed to be equivalent to a vertical electric dipole located on the ground plane. Curves are plotted which show: (a) the normalized impedance ratio, (b) the phase lag of the ratio, as a function of distance from 50 to 2000 km, for frequencies from 50 to 1600 c/s. The value of ω_r, an ionospheric conductivity parameter involving the electron density, collision frequency and the earth's magnetic field, is taken as 5×10^5 and h = 90 km. The shape of the curves is not appreciably modified if other values of ω_r and h are chosen. A method of utilizing these curves for determining the distance of a lightning flash from an observing station is suggested. A.Wilkinson

621.391.812.63

8274 **CROSS DISTORTION IN MULTICHANNEL F.M. LINKS DUE TO SCATTERED V.H.F. PROPAGATION.** A.V.Prosin.
Radiotekhnika, Vol. 15, No. 8, 3-12 (Aug., 1960). In Russian.

Uses the theory of wave scattering at turbulent non-homoge-

neities of the dielectric constant of the atmosphere to develop a method of calculating the cross distortion, leading to theoretical relationships between the cross noise power and tropospheric line parameters. Aerials with greater vertical and less horizontal directivity should be used to reduce distortion. But if the ratio of vertical polar diagram width to half zero angle of scatter is >0.75, aerial directivity is of no importance. Various other conclusions are illustrated graphically. The results agree qualitatively with those of Prosin, Elektrosvyaz, No. 5, (1959). D.E.Brown

621.391.63 : 551.5

8275 MOVEMENT OF THE F-LAYER OF THE IONOSPHERE DURING BAY DISTURBANCES OF THE EARTH MAGNETISM. H.Kohl.

Arch. elekt. Übertragung, Vol. 14, No. 4, 169-76 (April, 1960). In German.

The F-layer rises during positive-going geomagnetic disturbances and sinks again after the end of the disturbance. Existing theories attribute bay disturbances to an electric field of aurora origin which induces currents in the ionosphere. Martyn's theory of geomagnetic storms is expanded bringing into account the influence of the neutral gas. Motional equations of the plasma involved in the explanation of the F-layer sinking can be solved only approximately. From the rising movement of the F-layer and the simultaneously recorded geomagnetic bay disturbance the integral can be calculated of the ionospheric conductivity over the height. From the sinking rate of the layer after the disturbance, neutral gas density can be estimated. Results of evaluations are given. J.M.Silberstein

621.391.812.63

8276 THE CORRELATION BETWEEN WAVES OF DIFFERENT FREQUENCIES AFTER PASSING THROUGH A LAYER OF STATISTICALLY INHOMOGENEOUS MEDIUM. M.F.Bakhareva.

Radiotekhnika i Elektronika, Vol. 4, No. 1, 88-91 (Jan., 1959). In Russian.

The correlation coefficients at one point for the fluctuations of the amplitudes and phases of two waves of different frequencies after travelling through partially overlapping layers of a medium having large-scale random inhomogeneities of refractive index are obtained. The results are used to estimate the dimensions of E and F inhomogeneities and give values in agreement with experimental results. R.C.Glass

621.391.812.631

8277 S.E.A. PHENOMENA DUE TO NUCLEAR EXPLOSION. A.Kimpara.

Mem. Fac. Engng Nagoya Univ., Vol. 11, No. 1-2, 86-8 (Nov., 1959).

S.E.A. (sudden enhancement of atmospherics) phenomena were observed on the records of atmospherics at 21 and 27 kc/s at Toyokawa twice on Aug. 12, 1958, the maxima occurring at 0436 and 1051 U.T. The phenomena were not found at 10 kc/s. Outbursts on solar radio-wave frequencies of 9400, 3750, 2000 and 1000 Mc/s were also observed, with maxima near 0430 U.T. Previous experience has indicated that when s.e.a. phenomena are observed at 21 and 27 kc/s exclusively and not at 10 kc/s, they are correlated with Dellinger fade-outs, i.e., with the occurrence of abnormal D layers, such as may result from nuclear explosions in the upper atmosphere. S.E.A. phenomena due to the explosion on Aug. 1, 1958, were not observed in the records of atmospherics, which showed simultaneous increases at 10, 21 and 27 kc/s. At that time the neighbourhood of Japan was subject to heavy meteorological disturbances, which probably masked any s.e.a. phenomena. A.Wilkinson

621.391.812.641

8278 EQUATORIAL IONOSPHERIC EFFECTS. POST-SUNSET FADING ON LONG-DISTANCE RADIO CIRCUITS. T.W.Bennington.

Wireless Wld, Vol. 66, No. 10, 501-6 (Oct., 1960).

The cause of post-sunset fading is briefly discussed and then investigations of the reception at Singapore and at Johannesburg of h.f. broadcast transmissions from England are described. The data examined are those for the five hours following ground sunset at each place for the equinoctial months of March and September for the years 1954 to 1958 inclusive, the sunspot minimum occurring in April, 1954, and the maximum in March, 1958. At Singapore, very little fading was observed during the hours following local sunset in 1954 and 1955, but from 1956 to 1958 its rate of incidence increased with increasing sunspot number, the peak period for the fading being from one to two hours after sunset. At Johannesburg the fading reached fairly high incidence rates even during sunspot-minimum years, and increased with increasing sunspot number. The diurnal pattern was different from that at Singapore, the fading usually not starting till two hours after local sunset and at five hours after sunset being still near the maximum incidence rate. Discussion of the results, in conjunction with ionospheric data obtained at Singapore and at Ibadan, Nigeria, both of which are near the geomagnetic equator, indicates that the fading observed at Johannesburg is connected with an ionospheric phenomenon which is inversely correlated with magnetic disturbance, i.e. the occurrences of spread F near the magnetic equator, whereas the fading at Singapore is, at least partly, dependent on an ionospheric phenomenon which is not so correlated and which may, in fact, be the equatorial sporadic E. A.Wilkinson

621.391.814 : 621.397.61

8279 PROBLEMS OF U.H.F.TELEVISION: PROPAGATION. R.A.Rowden.

J. Televis. Soc., Vol. 9, No. 6, 223-9 (April-June, 1960).

A general discussion of various problems of u.h.f. propagation that have come to light recently as a result of investigations carried out in England and other countries. Particular problems arising (a) in the vicinity of the transmitter, (b) over the service area as a whole, (c) in the vicinity of the receiving site, (d) over long distances, are considered successively. Tests carried out in various towns in the neighbourhood of the Crystal Palace transmitter are described. It has been found convenient to express the extent of the local variations observed in these tests by a parameter related to the standard deviation of a series of readings. This parameter, termed the "variation factor", is the number of dB difference between the field strength exceeded at, say, 90% of the locations in the area under consideration, and the field strength exceeded at 50% of the locations. Extreme values of the variation factor in about 100 towns were 4 dB to 20 dB for Band V transmissions, but only 2 dB to 11 dB for Band I. It is of particular interest that for about half the towns the variation factor was nearly 6 dB greater at u.h.f. than at v.h.f. Although more transmitting stations are necessary to provide effective coverage of a given service area with u.h.f. transmissions than is the case with v.h.f. transmissions, the advantages of u.h.f. are such that it must be considered in planning new installations. A.Wilkinson

621.391.82

8280 REDUCING INTERFERENCE IN IONOSPHERIC SOUNDING. K.Perry.

Electronics, Vol. 33, No. 22, 118-20 (May 27, 1960).

Wanted pulses riding on interfering tone signals are detected by slicing circuits, the slicer level being automatically adjusted by rectifying the negative half cycles of the tone and feeding back a correcting voltage to the slicers. W.G.Stripp

621.391.821 : 551.5

8281 ATMOSPHERIC RADIO NOISE LEVELS AT POONA IN THE 2.5-20 Mc/s. BAND. S.V.Chandrashekhar Aiya, K.R.Phadke, S.V.Padmanabhan and C.K.Sane.

J. sci. industr. Res., Vol. 18B, No. 2, 47-53 (Feb., 1959).

Noise data in a form which includes both the amplitude and time characteristics of atmospheric radio noise are presented. The amplitude characteristics are given in terms of the r.m.s. noise field strength corresponding to the average power received per flash. The time charactistics are given in terms of the median, higher decile and lower decile values of the duration of the impulse which arises from a flash and of the minimum number of impulses per minute necessary to cause annoyance or impair intelligibility of any service. The actual numerical data pertain to Poona for the time block 1800-2400 hrs I.S.T. and for the frequency band 2.5-20 Mc/s.

621.391.821 : 551.5

8282 ATMOSPHERIC NOISE INTERFERENCE IN THE STANDARD BROADCAST BAND AT POONA. S.V.Chandrashekhar Aiya and C.G.Khot.

J. sci. industr. Res., Vol. 18B, No. 2, 54-66 (Feb., 1959).

A report of some of the investigations carried out at Poona on atmospheric radio noise in the standard broadcast band (0.535 to 1.605 Mc/s.) are presented. Systematic measurements were taken at 0.62 and 0.93 Mc/s. during the hourse 1800-2300 I.S.T., from March 1955 to February 1956, by a method previously described by

one of the authors [J. atmos. terres. Phys., Vol. 5, 230 (1954)]. A possible way of noise estimation is described and the actual estimates compared with measured values. In Appendix I are given the details of the equipment designed and used in the measurements and in Appendix II a comparison is made of the available estimates of atmospheric noise with the measured values.

621.391.822 : 551.5

8283 MEASUREMENT AND DESCRIPTION OF THE CHARACTERISTICS OF ATMOSPHERIC RADIO NOISE. S.V.Chandrashekhar Aiya.
J. sci. industr. Res., Vol. 18B, No. 2, 43-7 (Feb., 1959).

On the basis of the experimental and theoretical investigations carried out by the author and his collaborators at Poona during the hours of peak activity of tropical thunderstorms, an attempt is made to find an answer to the question of the C.C.I.R., namely, what are the most easily-measured characteristics of terrestrial radio noise from which the inference to different types of communication systems can be determined?

621.391.822.622 : 538.56

8284 THE "WAVEGUIDE MODE" THEORY OF RADIO WAVE PROPAGATION WHEN THE IONOSPHERE IS NOT SHARPLY BOUNDED. D.W.Barron.
Phil. Mag. (Eighth Ser.), Vol. 4, 1068-81 (Sept., 1959).

The propagation of radiowaves to great distances can be treated by considering the space between the earth and the ionosphere as a waveguide and discussing the properties of the various waveguide modes. Previous authors have generally assumed that the upper boundary of the waveguide is a sharply bounded homogeneous ionosphere. A method of calculating the mode characteristics for any horizontally stratified ionosphere in which the electron density and collision frequency vary with height in some arbitrary prescribed manner is described. The theory is given in full for a flat, perfectly conducting earth with no magnetic field, and its extension is outlined in an appendix. Results of some calculations carried out on EDSAC 2 are given. The effect on the waveguide modes of changing from a sharp to a gradual boundary on an otherwise homogeneous ionosphere is investigated by considering a variation of electron density (N) with height (z) according to the law

$$N = N_0(1 + \tanh \beta\,(z-h))$$

using a range of values of β, and mode characteristics are also calculated for an ionosphere in which the electron density increases exponentially with increasing height. The effect on the waveguide modes of changes in the parameters of the exponential model, and the difference between the modes for vertical and horizontal polarization are described.

621.391.823

8285 INTERFERENCE SUPPRESSION OF IGNITION EQUIPMENT OF MOTOR VEHICLES. W.Walter.
Tech. Mitt. P.T.T., Vol. 38, No. 5, 153-64 (1960). In German and French.

A general technical treatment of electrical interference, caused by internal combustion engines, is presented, describing the mechanism of impulsive interference due to ingition, methods of measurement and suppression, and standardized procedure of suppression adopted on all P.T.T. vehicles and also on motor cycles. The design of an ignition interference generator, to enable an accurate calibration of the employed field-strength meters, is singled out for a more detailed description. A.Landman

621.391.823

8286 SUPPRESSION OF P.T.T. MOTOR VEHICLES. E.Meister.
Tech. Mitt. P.T.T., Vol. 38, No. 8, 271-7 (1960). In German and French.

A statistical survey of ignition interference levels and characteristics caused by the P.T.T. fleet of over 1400 vehicles, undertaken at 62, 100, 155 and 220 Mc/s, followed by a brief discussion of the main causes of interference in the electrical system of a car and a description of quantitative methods of measurement. A.Landman

621.391.827.42

8287 INTERMODULATION EFFECTS IN F.M. AND P.M. SYSTEMS. B.E.Love.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 245-8 (1960) = Commun. and Electronics, No. 49 (July, 1960).

The discussion is concerned mainly with the measurement, evaluation, and correction of delay distortion, klystron pulling effects, and the determination of optimum system loading. H.L.Nattrass

RADIO APPLICATIONS . RADAR

621.396.93

8288 GUARDED ZONE SIGNALLING. W.B.Smith, Jr.
I.R.E. WESCON Convention Record, Vol. 4, Pt 7, 117-23 (1960).

A method of audio-frequency tone signalling which utilizes the maximum number of combinations of a given number of tone channels is described. The principle feature of this method is the use of all tones present as a positive space. Several typical applications of this method to selective calling are described. These include selective party-line telephone ringing, and aircraft selective call.

621.396.93

8289 MILITARY APPLICATIONS OF INFRARED TECHNIQUES. L.W.Nichols, W.A.Craven, R.W.Powell, R.S.Wiseman, M.W.Klein, W.L.Wolfe, M.R.Krasno, W.R.Wilson, M.Arck, G.Jankowitz and P.J.Ovrebo.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1611-24 (Sept., 1959).

The main applications are for homing missiles, gunfire control equipment, bomber defence, airborne early warning, ballistic missile detection, passive and active viewing systems, reconnaissance and communication. A description is given of the instruments used in the United States for these purposes, and a brief mention is added of Russian work. C.Hilsum

621.396.931

8290 POLICE AND FIRE DEPARTMENT COMMUNICATIONS CENTERS. A SYSTEMS APPROACH TO THE CONTROL CONSOLE AND RELATED FACILITIES. G.A.Brookes.
I.R.E. WESCON Convention Record, Vol. 4, Pt 7, 88-101 (1960).

The equipment provision for typical installations is discussed with particular emphasis on the facilities which are provided in the communications console. A description is given of the modular units such as amplifiers, control units, display units and signal-actuated recorder which have been developed for this application.

621.396.933

8291 INFRA-RED RADAR, SURVEILLANCE AND COMMUNICATIONS. I-II. C.M.Cade.
Brit. Commun. and Electronics, Vol. 7, No. 6, 414-18 (June); 510-17 (July, 1960).

A review article, in which some applications of infrared radiation are discussed. The requirements of an active infrared range-finding system are considered, and the probable performance deduced. Passive infrared systems can be used for detection and imaging, and some photographs taken with such systems are included. C.Hilsum

621.396.933 : 621.383 : 535.8

8292 OPTICAL DESIGN FOR INFRARED MISSILE-SEEKERS. H.Dubner.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1537-9 (Sept., 1959).

Various designs are described, and their faults discussed. The final design adopted uses a dome of Corning 0160 glass, a concave primary mirror, a plane secondary mirror and an arsenic trisulphide correcting lens. The system has no primary spherical aberration, no coma, no astigmatism, no field curvature, and little chromatic aberration. C.Hilsum

621.396.933.1

8293 ON THE POSSIBILITY OF USING INFRARED RADIATION FOR LONG-RANGE DETECTION OF OBJECTS FLYING AT SUPERSONIC SPEEDS. A.Welti and E.Girod.
Bull. Assoc. Suisse Elect., Vol. 51, No. 19, 900-10 (Sept. 24, 1960). In German.

Consideration is given to the aerodynamic heating of aircraft and rockets, and to the radiation emitted from the hot surfaces. The transmission of infrared radiation through the stratosphere and the troposphere is discussed. C.Hilsum

621.396.933.1

8294 ASTRONAUTICAL APPLICATIONS OF INFRARED TECHNIQUES.
P.J.Ovrebo, R.Astheimer and E.Wormser.
Proc. Inst. Radio Engrs, Vol. 47, No. 9, 1625-8 (Sept., 1959).

Infrared equipment can be used in satellites for controlling their attitude, using the sun, moon or earth as the source of infrared radiation. The satellites can themselves be detected and their orbits mapped with the use of infrared techniques. These applications are discussed and some details given of other applications such as weather forecasting. C.Hilsum

621.396.933.23

8295 PARA-VISUAL DISPLAY OF INFORMATION.
Control, Vol. 3, 107-8 (June, 1960).

An aircraft cockpit instrumentation system is described which utilizes so-called para-foveal vision i.e. it enables the pilot to look out of the cockpit at the landscape, yet at the same time detect errors in his flight direction from the corner of his eye. This is achieved by using instruments each in the form of a rotating helix which is servo driven from the appropriate radio aids and gyros, and which give the appearance of black and white bars moving left or right, or up and down, according to the flight path error. It has obvious applications with I.L.S. and it may be useful as a system monitor for completely automatic blind landing. K.C.Garner

621.396.933.4

8296 TRANSPONDER ALTITUDE ENCODERS FOR AIR TRAFFIC CONTROL. B.W.Glover.
Brit. Commun. and Electronics, Vol. 7, No. 9, 676-80 (Sept., 1960).

Describes in detail the construction and method of operation of an altitude encoder for a system designed to transmit altitude data to air traffic control in digital form. R.C.Glass

621.396.946

8297 R.F.I. [RADIO FREQUENCY INTERFERENCE] IN SATELLITE COMMUNICATION SYSTEMS. O.M.Salati.
Electronic Industr., Vol. 19, No. 4, 92-7 (April, 1960).

An account is given of the geometry of satellite orbits. The main features are summarized for space communication systems which have been used or are proposed. A list is given of the contributions to the noise output of a receiver, and it is shown that in order to secure low aerial noise-temperature special care is necessary in the suppression of side and back lobes. In order to minimize interference to other users from the high power transmitters required for satellite communication systems it will be necessary to have good suppression of harmonics. W.T.Blackband

621.396.946

8298 PROVIDING COMMUNICATION AND NAVIGATION FOR SPACE PROBES. R.C.Hansen and E.R.Spangler.
Electronics, Vol. 33, No. 28, 43-7 (July 8, 1960).

A general account is given of the system of receivers and command transmitters used for the Able space probe project. The four stations are at Jodrell Bank, Cape Canaveral, Hawaii and Singapore. Parametric amplifier first stages were used in the receivers and hence the optimum operating frequency was in the 400 Mc/s band. Estimates are made of the limiting ranges for satisfactory performance under various conditions.

W.T.Blackband

621.396.946

8299 THE MINIMUM-RANGE EQUATION AND THE MAXIMUM DOPPLER-FREQUENCY SHIFT FOR SATELLITES.
K.Toman.
Proc. Inst. Radio Engrs, Vol. 48, No. 7, 1339-40 (July, 1960).

Expressions for the Doppler-frequency shift, Δf, are derived for satellites in elliptic orbits. Plots of Δf against angle of elevation are given for two satellites, one of normal velocity and one having a velocity 99% of that of light. For the latter both maximum and minimum turning points of the Δf versus θ curve are sharp and easy to determine. W.T.Blackband

621.396.96

8300 SIMULATION OF RADAR COUNTERMEASURES.
J.I.Leskinen.
Electronics, Vol. 33, No. 31, 98-9 (July 29, 1960).

The equipment described is a vehicle - mounted X-band interference simulator. Switchable waveform-generators modulate a klystron oscillator with square waves, noise, pulses or sine waves, and a horn aerial directs the transmission toward the radar aerial so that the interference is displayed on the radar c.r.t. It is used to train students in selecting the appropriate counter-countermeasure.
W.G.Stripp

621.396.96

8301 MAPPING CAVES MAGNETICALLY.
E.R.Roeschlein.
Electronics, Vol. 33, No. 39, 61 (Sept. 23, 1960).

Describes a transistorized 5 W, 2 kc/s transmitter feeding a tuned loop which is located underground. The magnetic induction field is picked up at the surface by a similar tuned loop which feeds a transistorized receiver. The range of this transmitter–receiver is approximately 400 ft. Mapping is by null location and depth measurement by signal attenuation. D.J.Truslove

621.396.96

8302 PROBABILITY OF DETECTION FOR FLUCTUATING TARGETS. P.Swerling.
I.R.E. Trans. Inform. Theory, Vol. IT-6, No. 2, 269-308 (April, 1960).

Probability of detection of a target by a pulse search radar is considered when the target has a fluctuating cross-section. Formulae for detection probability are derived and curves of detection probability versus range are given for four different target fluctuation models. These models represent two different probability-density functions for scan-to-scan and pulse-to-pulse fluctuations respectively. It is shown that the probability of detection is less than that for a steady target if the range is sufficiently short and is greater if the range is sufficiently long. The amount by which the fluctuating and non-fluctuating cases differ depends on the rapidity of fluctuation and on the shape of statistical distribution. S.C.Dunn

621.396.69

8303 THE SYNTHESIS OF VELOCITY–INERTIAL NAVIGATION SYSTEMS. F.V.Johnson.
Proc. Nat. Electronics Conf., Vol. 15, 784-93 (1959).

A useful approach to the study or synthesis of velocity–inertial navigation systems is through the concept of mixing of velocities determined inertially and non-inertially. A generic system is deduced which uses one mixing function to obtain the feedback velocity for leveling the accelerometers, and another function for the output to the geographic position computer. Most, if not all, velocity–inertial systems can be described and related in a simple fashion in terms of this generic system and its mixing functions.

621.396.96

8304 THE B.M.E.W.S. AUTOMATIC MONITORING SYSTEM.
E.L.Danheiser and M.Korsen.
I.R.E. WESCON Convention Record, Vol. 4, Pt 6, 136-40 (1960).

An automatic system which monitors and isolates faults for the ballistic-missile early-warning system radar system is described. Utilizing digital as well as analogue techniques, it provides fault sensing and fault isolation routines. Key signals in every major subsystem are continuously checked against thresholds set to system tolerances. A detailed sequential check of the faulty subsystem is initiated when a continuous fault appears. Sequential checking is programmed by punched cards with each card containing all information necessary to test a particular point. Examples of standard as well as special methods of fault sensing techniques are described. A detailed explanation of some of the key circuitry is given and its specific relation to the overall automatic monitoring system is described. Accuracies and tolerances for some of the key items are also included and reliability factors are discussed.

621.396.96 : 523.16

8305 RADAR DETERMINATION OF THE SCATTERING PROPERTIES OF THE MOON. F.B.Daniels.
Nature (London), Vol. 187, 399 (July 30, 1960).

To determine the scattering properties of the lunar surface, the distribution in depth of the scattering elements must be considered. A study of the general problem of reflection from a plane surface having random irregularities that are a function both of space coordinates and time was applied to the case of lunar radio echoes.
C.Hazard

621.396.96 : 523.16

8306 ROUGHNESS OF THE MOON AS A RADAR REFLECTOR.
B.H.Briggs.
Nature (London), Vol. 187, 490; Correction, 466 (Aug. 6, 1960).

Radar and optical measurements of the slope of the lunar surface both indicate a mean slope of the order of 3°. Smaller structure appears to have a root mean square value of slope considerably less than 3°. C.Hazard

621.396.96

8307 FORWARD SCATTERING BY COATED OBJECTS ILLUMINATED BY SHORT WAVELENGTH RADAR. R.E.Hiatt, K.M.Siegel and H.Weil.
Proc. Inst. Radio Engrs, Vol. 48, No. 9, 1630-5 (Sept., 1960).

Theoretical and experimental results are presented concerning the ineffectiveness for forward scattering of radar absorbing coatings applied to highly conducting objects which are large with respect to the wavelength of the incident energy. It is shown that such coatings can only increase the energy in the forward lobe of the scattering pattern. A rather simple accurate theoretical estimate is obtained of the width of this lobe for a sphere and verified experimentally. By using absorbing coatings, experimental verification is obtained of theoretical predictions of the energy focussing and reflecting effects at the rear of thin prolate spheroids. Finally a section is devoted to the experimental procedures and equipment used to obtain the forward scattering data.

621.396.96

8308 THE INEFFECTIVENESS OF ABSORBING COATINGS ON CONDUCTING OBJECTS ILLUMINATED BY LONG WAVELENGTH RADAR. R.E.Hiatt, K.M.Siegel and H.Weil.
Proc. Inst. Radio Engrs, Vol. 48, No. 9, 1636-42 (Sept., 1960).

Theoretical and experimental electromagnetic scattering results are presented concerning the effects of applying thin coatings to perfectly conducting scatterers. Most of the paper is concerned explicitly with spheres and cones. It is shown that thin coatings can have little effect on the Rayleigh scattering cross-sections. It is also pointed out how the effect of conductivity is enhanced at low frequencies and how, as a consequence, a thin slightly lossy spherical shell scatters like a perfectly conducting sphere in the Rayleigh region.

621.396.96

8309 RADAR TARGET ANGULAR SCINTILLATION IN TRACKING AND GUIDANCE SYSTEMS BASED ON ECHO SIGNAL PHASE FRONT DISTORTION. D.D.Howard.
Proc. Nat. Electronics Conf., Vol. 15, 840-9 (1959).

The slope of the phase front of the echo signal from a finite size complex target is shown to be identical to the angular errors caused in tracking radars by angular scintillation of target angle noise. Since angle tracking systems are essentially phase front measuring devices, it is demonstrated that the target angle noise is contained in the echo signal as a distortion of its phase front. This new concept aids in visualizing the source of target angle noise and in assessing the effects of target angular scintillation or target angle noise on any target locating device. As an example, it is shown that identical target angle noise errors also occur in search radar.

621.396.96

8310 THE STATISTICS OF RADAR VIDEO AFTER LINEAR AND NONLINEAR MIXING. P.R.Dax.
Proc. Nat. Electronics Conf., Vol. 15, 850-9 (1959).

In many radar applications, two or more video channels have to be mixed to produce a single channel of information. Two examples are: (1) the stacked-beam radar where a signal may exist in one out of n beams and where a composite plan picture is required; (2) the multifrequency radar where a signal may exist simultaneously in all n channels and where maximum signal enhancement is required in the common channel. The statistics of the video after resistance (linear) mixing or diode (peak or trough selection)) mixing are derived. The efficiency of the various methods is compared in terms of the signal-to-noise ratio required at the input to provide a given probability of detection with a given probability of false alarm at the input.

621.396.96

8311 BATTERY-POWERED MARINE RADAR. L.H.Dawson.
Wireless Wld, Vol. 66, No. 8, 381-5 (Aug., 1960).

A power supply for small-craft radar equipment is described. A high-power transistor with cooling fins is used as the series element of the stabilizer. The h.t. potentials, supplies for magnetron and klystron heaters and auxiliary supply for the stabilizer are obtained from a special convertor which makes use of the abilitv of transistors, when "bottomed", to pass large current with a low potential drop between collector and emitter. The switching action is controlled by a drive waveform applied to the bases, the base drive being conveniently obtained by transformer action from the output so that the circuit resembles a push-pull oscillator. The h.t. transformer is provided with tappings at levels up to 2 kV. A voltage-doubler rectifier delivers 4 kV for the magnetron and further rectifiers multiply by 6 to give 11 kV for the cathode-ray tube. H.A.Miller

621.396.96 : 621-52

THE DYNAMIC PROPERTIES OF RANGE-TRACKING LOOPS WITH TWO INTEGRATORS. See Abstr. 6992

621.396.96 : 621.376.5

SEMICONDUCTOR MODULATOR FOR MISSILE-TRACKING RADAR TRANSPONDER. See Abstr. 7908

621.396.96 : 621.396.677

DESIGN OF A SPECIAL-SHAPE AERIAL FOR SCANNING RADAR. See Abstr. 8232

621.396.96 : 621.372.837.2

V.S.W.R. AND LOSS RESPONSE OF A BALANCED DUPLEXER VERSUS DISTANCE BETWEEN THE MAGNETRON AND GAS DISCHARGE CELLS. See Abstr. 7685

621.396.96 : 621.395.625.3

APPLICATION OF THE TV TAPE RECORDER TO RADAR SIGNAL RECORDING. See Abstr. 8168

621.396.962

8312 BROAD-BAND FREQUENCY-SCANNING RADAR SYSTEM. S.R.Hennies and J.V.N.Granger.
Electronics, Vol. 33, No. 36, 44-7 (Sept. 2, 1960).

Describes with the aid of block schematics a radar system which sequentially scans seven frequencies in the 6 to 50 Mc/s band at 60 frequencies per second, and operates on a coherent basis in providing Doppler data on each frequency. Peak power is 15 kW. The phase–path display enables an accurate determination of target velocity to be made, and when scanning ionized clouds the diffusion rate may be determined. C.A.Hogarth

621.396.962

8313 MULTIPLE TARGET RESOLUTION OF MONOPULSE VERSUS SCANNING RADARS.
S.F.George and A.S.Zamanakos.
Proc. Nat. Electronics Conf., Vol. 15, 814-23 (1959).

The lack of information on the multiple target resolution characteristics of operational radars prompted a study of the inherent angle resolving powers and angle error sensitivities of the most prevalent tracking systems: amplitude comparison monopulse, conical scan, and two forms of sequential lobing. The measure of multiple target resolution used is the minimum angle target separation which will permit the radar to determine the presence of more than a single target and allow the radar to locate accurately each target present. The results of this study show that the monopulse radar has the greatest resolution capability for a given aerial aperture and beamwidth. It also has greatest angle-error sensitivity for a given aerial gain. However, the advantages of monopulse in these respects are relatively small.

621.396.963.3

8314 DESIGN CONCEPTS OF A HIGH-BRIGHTNESS AIRBORNE RADAR INDICATOR. E.W.Koenig.
Elect. Commun., Vol. 36, No. 2, 132-8 (1960).

The Iatron display tube is capable of a brightness of 3000 ftL, a resolution of 30 lines/inch, 5 shades of gray in contrast and can be veiwed in direct sunlight. The indicator unit, display tube and their circuits are described in detail. A.Reiss

621.396.962.3

8315 RADAR TESTER NEEDS WIDE BAND A.F.C. J.T.Harper and J.L.Redifer.
Electronic Industr., Vol. 19, No. 5, 92-6 (May, 1960).

The tester responds to an elevation-search KU band radar, generating r.f. pulses at the p.r.f. of the radar but with variable delay. To tune the klystron to the radar frequency, the input signal is passed through 8 filters and a diode matrix to four binary regis-

ters. The information is stored during the passage of the nodding radar beam. The store outputs are added to set the input signal to the servo-amplifier, so as to tune the klystron mechanically into the correct 67 Mc/s wide band. Fine tuning is by means of a phantastron sweep generator. W.G.Stripp

621.396.963

8316 RADAR DISPLAY TRANSMISSION BY LINE STORAGE. R.Arnolds.

Elektronik, Vol. 9, No. 6, 171-8 (June, 1960). In German.

The storage problem is analysed from the point of view of range and bearing resolution, and the maintenance of signal–noise ratio. Improvements in storage tubes and methods of write-in and read-out are described. In one tube the beam is shaped to a narrow rectangular cross-section and is deflected vertically by echo signals. Positive or negative signals can be read out by scanning horizontally at a suitable vertical level. Beam current modulation is unnecessary in this method. Resolution can be improved by using a circular scan. A double-beam tube is used with provision for exact superposition of the two circular traces. Only 90% of the trace is used for writing, but the reading scan uses the full circle, thus providing the dead time necessary for time-base operation. W.G.Stripp

621.396.963.3

8317 ON THE EFFECT OF C.R.T. TRANSFER FUNCTION ON DETECTION THRESHOLD.

C.W.Miller and W.R.Minty.

I.R.E. WESCON Convention Record, Vol. 4, Pt 4, 134-45 (1960).

The intensity-modulated c.r.t. is a nonlinear device, whose output brightness varies approximately as the 5/2 power of input signal voltages. This transfer function is not optimum for many display applications, and experiments have been performed by inserting a variable transfer-function device into a closed-loop television and a simulated radar system to demonstrate the seriousness of the degradation of performance caused by less than optimum parameters. In both experiments minimum detectable signal thresholds of human operators were improved between 6 and 13 dB over "normal" conditions by changing system transfer function alone. The implications for system design are discussed.

621.396.969.1

8318 SCHEMES FOR DETECTION OF WEAK RADAR SIGNALS. J.Szyszkiewicz.

Arch. elektrotech. (Warsaw), Vol. 8, No. 3, 433-67 (1959). In Polish with summary [2 pp.] in English.

Theories of detection of radar signals are reviewed with emphasis on target velocity detection by the Doppler effect. Different schemes for detection of azimuth, range and velocity are considered and their effectiveness or practicability assessed. An original scheme is proposed with a drum memory and a repeated use of signal processing channels, which can save a considerable amount of equipment. 10 references, mainly English. A.Woroncow

621.396.969.1 : 621.317.39

8319 THE INDETERMINACIES OF MEASUREMENTS USING PULSES OF COHERENT ELECTROMAGNETIC ENERGY. R.Madden.

Proc. Instn Elect. Engrs, Monogr. 417E, publ. Nov., 1960, 5 pp. To be republished in Part C.

The measurements, on a single pulse function of electromagnetic radiation, of the position of a scatterer with polar coordinates R, ϕ are interdeterminate in themselves. The positional indeterminacies are related by $\Delta R \Delta\phi \cong \frac{1}{4}\lambda_t$, where λ_t is the wavelength of the source. The relation between the indeterminacies of range R and radial velocity V_r is found to be $\Delta R \Delta V_r \cong \frac{1}{4}\lambda_t c$. It is shown that vector position and vector velocity are not measurable simultaneously, and it is suggested that the 3-dimensional measurement problem is basically limited to non-simultaneous measurements which have restrictions in the presence of multiple scatterers. Similarity is noted to the quantum-mechanical problem.

621.396.97

8320 TECHNICAL REQUIREMENTS FOR F.M.STEREOPHONIC MULTIPLEX BROADCASTING. R.J.Farber.

I.R.E. WESCON Convention Record, Vol. 4, Pt 7, 36-9 (1960).

The work of N.S.R.C. panel I on system specifications is reviewed. Reports on 1960 field trials were then awaited. The bearing of F.C.C. rules on multiplex stereo broadcasting as regards sub-carriers, modulation excursions etc., is discussed. Stereo signals can be processed in various ways such as L + R, L – R, 2L – R, etc. Some arrangements give simpler and more reliable matrixing than others. Mention is made of precedence effect steering signals such as L' /(L' + R'), where L' and R' are derived by processing the L and R signals. Sub-carrier modulation methods include f.m., a.m., a.m., with suppressed carrier or single sideband. It is possible to use more than one sub carrier so as to convey hired music etc. Sub-carrier cross-talk may degrade the stereophonic results. M.L.Gayford

621.396.97

8321 PLANNING AND INSTALLATION OF THE SOUND BROADCASTING HEADQUARTERS FOR THE B.B.C.'S OVERSEAS AND EUROPEAN SERVICES. F.Axon and O.H.Barron.

Proc. Instn Elect. Engrs, Paper 3213E, publ. April, 1960 (Vol. 107B, 485-96, 496-8).

Republication, with discussion, of the paper already abstracted as Abstr. 3147 of 1960.

TELEVISION

621.397.12

8322 IMAGE SIMULATION AND INTERPRETATION. G.L.Meyer.

Proc. Nat. Electronics Conf., Vol. 15, 335-45 (1959).

Technological difficulties limit the excellence of sensing–transmitting systems for use in satellites. Two experiments were conducted to determine the relation between the quality of the image and the quality of the information that can be extracted from it. An image simulator was constructed to produce imagery that could be used with trained photo-interpreters in the experiments. As a result of the experiments a technique of evaluating the usefulness of various quality imagery began of solidify. Much work in evaluation still remains to be done, especially in the areas of subjective analysis as opposed to form recognition.

621.397.132

8323 HENRI DE FRANCE COLOUR TELEVISION SYSTEM. R.Chaste and P.Cassagne.

Proc. Instn Elect. Engrs, Paper 3251E, publ. April, 1960 (Vol. 107B, 499-507, 507-11).

Republication, with discussion, of the paper already abstracted as Abstr. 3786 of 1960.

621.397.2 : 621.376.56

8324 VIDEO TRANSMISSION OVER TELEPHONE CABLE PAIRS BY PULSE CODE MODULATION. R.L.Carbrey.

Proc. Inst. Radio Engrs, Vol. 48, No. 9, 1546-61 (Sept., 1960).

An experimental seven digit pulse code modulation system has been built for the transmission of monochrome and colour television signals over seven pairs of 22-gauge exchange area telephone cable, installed in the laboratory. A beam coding tube converts the signal to seven parallel digits of a binary Gray code at a 10 Mc/s rate. All circuits except the coding-tube deflection amplifier are transistorized. The coded digits are sent over the cable in parallel form with alternate groups converted to complements of the coded signal, thus substantially removing the low-frequency component. This makes it possible to use simple repeaters without special compensation for duty factor variation. A repeater group is used after every foot section of cable. One ten megabit repeater, consisting of an amplifier and blocking oscillator, is required for each digit. All seven digit repeaters are retimed with a common timing wave. At the decoding terminal, transmitted complements are restored to Gray code before translation to natural binary. A binary weighted resistance network decoder converts the signals to a quantized reproduction of the video signal. Good quality composite colour and monochrome pictures are obtained with six digits. Seven digits are believed to be necessary for broadcast quality with some margins. Waveform photographs illustrate the various functions, and photographs of decoded pictures are shown.

621.397.331.222

8325 THE VIDICON. A.Fryszman.

Przeglad Elektron, Vol. 1, No. 1, 19-22 (1960). In Polish.

A brief description of development work done in Poland on television camera tubes of Vidicon type. A.Woroncow

621.397.331.24

8326 THE REFLECTED-BEAM KINESCOPE. H.B.Law and E.G.Ramberg.

Proc. Inst. Radio Engrs, Vol. 48, No. 8, 1409-17 (Aug., 1960).

The reflected-beam kinescope (television picture tube) is a short tube particularly suited for picture sizes of 21 in. or more. It retains the conventional gun and external deflection components and is axially symmetric. Although the effective deflection angle is nearly 180°, the deflection power required is equivalent to that used in conventional 90° types. The electron beam scans through an apertured phosphor screen and is reflected back to the screen by the faceplate. The screen attenuates the beam by a factor of 4, except in the case of a radial scan, where a cutout in the centre of the screen may be made to permit free passage of the beam. The results of a theoretical and experimental study of the tube are presented. They show the raster to be inherently barrel-distorted. However, the distortion may be corrected in several ways. The resolution is somewhat lower than in standard tubes, although it is considered to be adequate. High detail contrast is obtained.

621.397.6

8327 A WIDE-BAND TELEVISION SWITCHING SYSTEM. R.S.Aha.

J. Soc. Motion Picture Televis. Engrs, Vol. 69, No. 4, 256-8 (April, 1960).

The system enables up to 14 video control panels to be independently switched to any of 20 output circuits. It consists of input amplifiers, switching relays, pre-amplifiers and output amplifiers. The input and amplifier stages are identical, each consisting of a series compensated pentode stage, d.c.-coupled to a triode cathode-follower and a hybrid double-triode. The pre-amplifier embodies a double triode operating as a cascaded amplifier. Control is effected by special relays whose capacitance across open contacts is only 0.8 pF. The system handles signals of about 1 V level, the gain is adjustable from 0.1 to 2.0, the response is level within ± 1.0 dB up to 17 Mc/s and the crosstalk at 17 Mc/s is below −40 dB. The whole system is rack-mounted.

H.G.M.Spratt

621.397.6 : 621.395.625.3

8328 A CONTRIBUTION TO THE CHOICE OF THE CARRIER FREQUENCY AS WELL AS THAT OF THE BAND-WIDTH OF THE F.M. CHANNEL AND OF THE CIRCUITRY OF A MAGNETIC RECORDING EQUIPMENT FOR TELEVISION PICTURE SIGNALS. W.Dillenburger.

Rdfunktech. Mitt., Vol. 4, No. 3, 113-29 (March, 1960). In German.

The use of either a low or a high carrier frequency has its drawbacks. Accordingly, to utilize the recording equipment to its best advantage, it is advocated that a low carrier frequency should be employed on the tape and that the f.m. band should subsequently be converted to a higher frequency, e.g. about 50 Mc/s, prior to demodulation. A frequency modulator is described in which the frequency is varied by controlling a dynamic ohmic resistance in acccordance with the modulation voltage. The frequency—video signal characteristic is practically linear and with a deviation of 2.5 Mc/s, the a.m. is scarcely 1.5%. A double push-pull demodulator is used in combination with a symmetrical limiter. The resolution of the system is 5 Mc/s and with good heads there is no distortion of the leading edges of the picture.

H.G.M.Spratt

621.397.61 : 621.372.55

8329 PHASE CORRECTION IN TELEVISION. G.Melchior.

Ann. Radioelect., Vol. 15, 243-52 (July, 1960). In French.

Phase distortion in v.f. and h.f. circuits is explained and the various methods of measurement, each with its own shortcomings, are discussed. Phase correction in either transmitters or receivers is best incorporated in the v.f. circuits and is effected by the inclusion of lattice-type filters. Such filter stages, if of conventional form, are extremely difficult to design. However, a filter circuit embodying a cathode-follower and voltage amplification enables resistive elements to be employed without loss of gain, provides a constant input and output impedance and facilities the inclusion of a variable element.

H.G.M.Spratt

621.397.61

8330 DESIGN FOR A TRANSISTORIZED CLOSED-CIRCUIT TV CAMERA. R.J.Clark.

Electronic Industr., Vol. 19, No. 7, 176-8, 82, 84-5 (July, 1960).

Designed for working under extremely arduous conditions such as over the hot line of an aluminium processing plant or to withstand the tremendous shock waves on a missile launching site, this camera is only 5½ in. diameter × 11¾ in. long and weighs 9 lbs. The camera is self-contained with remotely controlled focus, turret, iris and douser accessories and has no external circuits. The component boards have eyelets spun in at the required points wired with teflon-covered wire instead of printed boards. The Vidicon tube has a unit containing deflection, focus and alignment coils specially constructed to withstand shock and vibration. The video chassis uses a valve input followed by 11 transistor stages. Three motors, two solenoids and a clutch control the remote operation functions. 10 photographs are given.

B.B.Austin

621.397.61

8331 DESIGNING TRANSISTORIZED TELEVISION CAMERAS. D.G.Carreon.

Electronics, Vol. 33, No. 37, 72-5 (Sept. 9, 1960).

The advantages of a transistorized camera equipment (reliability and long life, compactness, low-power drain) are pointed out, resulting in the design of the new camera, with 1 in. Vidicon and 28 germanium transistors and operated off 20 V. The equipment is described in detail, illustrated by a functional block diagram and singled-out circuit diagrams of the following parts; low-noise head amplifier input, amplified video a.g.c., d.c. clamp, sync. blocking oscillator, 31.5 kc/s crystal master oscillator r.f. modulator and output. Particular emphasis is placed on temperature compensation and operating stability, a number of thermistors and Zener diodes being used for the above purpose.

A.Landman

621.397.61

8332 TELEVISION TRANSMITTERS FOR BANDS IV/V USING TETRODE TUBES. U.Finkbein, J.Holle and S.Tobies.

Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 9, 332-8 (April 25, 1960). In German.

Describes transmitters working over the 470-790 Mc/s band using the RS 1052 and RS 1032 tetrodes (see Abstr. 1694 of 1960). Power stages giving picture signals of 2, 10 and 20 kW are available.

A.H.W.Beck

621.397.61

8333 THE TEST-LINE SIGNALS OF THE FRENCH TELEVISION SERVICE. A.Pouyferré and G.Frachet.

Rdfunktech. Mitt., Vol. 4, No. 4, 153-7 (April, 1960). In German.

In this 819-line system there is a 38-line interval between the frame synch. signal and the start of picture signals. The last five blank lines are utilized to carry signals for testing transmission and receivers. The signal in the first of these lines is a trigger pulse for operating test instruments. The other lines carry grey signals, a 'staircase' series of pulses and a train of sinusoidal cycles. The details of the signals, i.e. their duration and amplitude, are fully specified and their purposes stated. Appropriate ancillary test apparatus is suggested.

H.G.M.Spratt

621.397.61

8334 ON APERTURE DISTORTION [IN TV CAMERA TUBES]. J.Valsa.

Slaboproudy Obzor, Vol. 21, No. 7, 413-17 (1960). In Czech.

The aperture distortion produced by television camera tubes is analysed. Non-storage tubes are first considered and it is assumed that the scanning is done by means of an aperture (e.g. Nipkow disk). Such systems are characterized by the following parameters; light flux distribution function $R(\eta)$, a transient characteristic $A_T(\eta)$ and an equivalent amplitude and phase characteristic $A_F(\eta)$. These characteristics are determined for uniformly "transparent" square and circular apertures, a circular aperture whose light transmission coefficient is variable and a symmetrical aperture whose transmission coefficient obeys the Gaussian law. The above analysis is extended to storage-type tubes, where $R(\eta)$ represents the current distribution in the scanning beam. The transient characteristics of these tubes are evaluated.

R.S.Sidorowicz

621.397.61 : 621.391.814

PROPAGATION OF TELEVISION SIGNALS AT U.H.F.

See Abstr. 8279

621.397.611

8335 THE OPTICAL OBJECTIVE SYSTEM IN TELEVISION AND ITS TRANSMISSION CHARACTERISTICS, BASED ON ITS AMPLITUDE AND PHASE RESPONSE. H.Grabre and F.Below.
Rdfunktech. Mitt., Vol. 3, No. 3, 145-52 (June, 1959). In German.

The relationship between optical (lines/mm) and electronic resolution on the surface of a photo cathode is explained and discussed, followed by consideration of contrast transmission problems, and of practical methods of measuring the contrast transmission coefficient with the aid of a micro-slit, a number of various test systems being described in some detail. The spatial frequency band of an optically resolved test chart or pattern is converted into a sequentially scanned signal with certain transient response; thus it is possible to apply amplitude and phase-response appraisal methods to the evaluation of the optical part alone. Once the "slit-function" (mainly a function of the scanning aperture shape) is known, the responses can be calculated by means of Fourier analysis or established empirically. The author's equipment, developed in the Hamburg Rundfunktechnik Institute and employing a rotating multi-slit drum, is shown to yield directly the required response data. A.Landman

621.397.62

8336 A TRANSISTORIZED PORTABLE TELEVISION RECEIVER. A.R.Curll.
I.R.E. Trans Broadcast and Televis. Receivers, Vol. BTR-6, No. 1, 9-16 (May, 1960).

This receiver incorporates a 30° projection c.r.t., 8 ½ in. in length and 2½ in. in face dia. The optical system consists of a beam splitter and a spherical mirror giving a virtual image corresponding in size to the picture obtained with a 14 in. direct-viewing c.r.t. Power supply is obtained from a 7.5V rechargeable battery of 2.4 Ahr. Recharging of this battery requires strict control. Other points of interest are: (1) the use of forward and backward a.g.c. in the 4-transistor i.f. amplifier; (2) the inclusion of a noise-switch transistor with the synch. separator; (3) the inclusion of a buffer stage between line oscillator and output stage; (4) the necessity for expensive electrolytic capacitors in the frame-deflection circuits to ensure stability during life; and (5) the 20 μA 8 kV e.h.t. supply, derived from two thermionic rectifiers driven from the line output transistor. H.G.M.Spratt

621.397.62

8337 THE PROBLEM OF THE UNRESTORED TELEVISION RECEIVER. R.J.Nissen.
J. Soc. Motion Picture Televis. Engrs, Vol. 69, No. 8, 521-7 (Aug., 1960).

It is maintained that correct grey-scale reproduction is the most important parameter of television picture fidelity. Under certain picture conditions, the absence of d.c. restoration in the modern home receiver will almost totally destroy proper grey-scale reproduction. Set manufacturers were queried as to their reasons for excluding this critical circuit. To compensate for the unrestored picture, until restoration circuits are again included in the home receiver, operating procedures and standards based on the use of the transmission waveform as a guide are proposed.

621.397.62

8338 TERMINATION OF THE AERIAL CABLE IN TELEVISION [RECEIVERS]. F.Andueza.
Rev. Telecom., Vol. 15, No. 60, 2-10 (June, 1960). In Spanish.

The transmission lines joining the aerial to the receivers have to fulfill certain conditions for maximum transfer of energy. In general the prime question is the elimination of possible reflected waves due to mismatch. Various types of terminators for matching the cable to the input circuit of the receiver are considered. Notes are given on sensitivity, noise level and the construction of the cable itself. A table is given showing the noise figures of some typical receiver input circuits. A.C.Brown

621.397 62 : 621.317.34

MEASUREMENT ON TELEVISION RECEIVERS. See Abstr. 7428

621.397.62 : 621.396.662

PERMEABILITY TUNERS FOR TELEVISION. See Abstr. 8207

621.397.621

8339 MEASUREMENTS OF PICTURE-TUBE PARAMETERS. A.Kotuszewski.
Przeglad Elektron., Vol. 1, No. 1, 22-6 (1960). In Polish.

The parameters are described and the method of measurement indicated with some of the results. Basic components of the apparatus are: an electro-optical probe (1 mm × 0.2 mm) and a luminescence meter. Others are: control raster generators, mixers for the composite vision signal and sync. pulses, an oscilloscope and power supplies. A.Sczaniecki

621.397.621 : 621.373.43

A NEW VERTICAL TIME BASE FOR TELEVISION RECEIVERS. See Abstr. 7710

621.397.7

8340 TECHNICAL EQUIPMENT AND FACILITIES OF THE B.B.C. TELEVISION CENTRE, LONDON. H.Bishop.
E.B.U. Rev. A, No. 63, 190-6 (Oct., 1960).

The completed and partially completed parts of the centre are described with particular reference to Studio 3 already in operation. The facilities, equipment and control facilities incorporated in the three control rooms associated with this studio, the production control, vision and lighting control and sound control rooms, are reviewed in detail. The presentation suite, not yet fully operative, consists of a central control room, two presentation studios and their associated control rooms. It also includes the international control room which will be the focal point of all programmes to and from Europe. Other equipment and plant mentioned are tape machines, film scanners, the internal telephone system, multicore coaxial cables and the power supplies. H.G.M.Spratt

621.397.7

8341 MODERN PROBLEMS IN THE DESIGN OF MASTER CONTROL SYSTEMS. L.W.Germany.
Rdfunktech. Mitt., Vol. 4, No. 4, 145-52 (April, 1960). In German.

Describes a number of control consoles for installation in the main control room of a television station with several studios and handling sponsored programmes in which advertising matter has to be injected. The various incoming signals to be switched and controlled, e.g. synch. and test signals, are listed. Three types of console are recognized, manual, semi-automatic and automatic, examples of which are described, including switching methods. For the automatic type of console a system in which the timing of a complete programme is controlled by punched paper tape is outlined. H.G.M.Spratt

621.397.712.3

8342 WIRELESS (TELEVISION) STUDIO-CONTROL EQUIPMENT. A.Rettig, J.Balodis and H.Vorrath.
Rdfunktech. Mitt., Vol. 4, No. 3, 102-112 (March, 1960). In German.

Such an installation is required to provide a oneway speech channel between control cubicle and operating staff during rehearsals and broadcasting. The requirements of the system, of which absence of interference with the television channel is the most important, are listed. An early inductive-loop system proved unsatisfactory mainly owing to interference. Two alternative systems have since been found satisfactory: (1) 3-channel a.m. transmission at 37.75-37.9 Mc/s using either valve or transistorized receivers; and (2) 4-channel narrow-band f.m. transmission at 23.43-70.31 kc/s using transistorized receivers. Design details of transmitters and receivers are given. H.G.M.Spratt

621.397.743

8343 REQUIREMENTS AND MEASUREMENTS FOR LONG-DISTANCE TV TRANSMISSION. J.Müller.
Nachrichtentech. Z. (N.T.Z.), Vol. 13, No. 7, 327-34 (July, 1960). In German.

Based on the 625-line, 5 Mc/s video-band system, part I reports on conclusions of this long-standing investigation in conjunction with the C.C.I.R. recommendation No. 267. Part II reports on the measurements carried out on a 2000 km composite transmission link in accordance with the above C.C.I.R. recommendation. In part III the early knowledge is discussed for the transmission of N.T.S.C.-system colour pictures. 7 references, 22 illustrations. A.Reiss

621.397.8

8344 DISTORTION DUE TO SYSTEM AND TRANSMISSION FAULTS IN COLOUR TELEVISION ACCORDING TO THE N.T.S.C.-SYSTEM. H.Schönfelder.

Rdfunktech. Mitt., Vol. 4, No. 4, 158-72 (April, 1960). In German.

Linear and non-linear distortion is discussed but shown to be relatively unimportant. Again, the effect of interference due to reflections is comparable with that in black-and-white television. Level-dependent phase errors are more serious as they give rise to changes in colour shade which cannot be corrected by phase adjustment in the receiver. System faults, each of which is discussed in turn, arise from the complexity of the N.T.S.C.-system and from simplification of the receiver circuitry. Generally, they are perceptible only when test patterns are transmitted.

H.G.M.Spratt

621.397.81

8345 PICTURE QUALITY — PROCEDURES FOR EVALUATING SUBJECTIVE EFFECTS OF INTERFERENCE. G.L.Fredendall and W.L.Behrend.

Proc. Inst. Radio Engrs, Vol. 48, No. 6(I), 1030-4 (June, 1960).

Describes a series of tests in which 200 lay observers providing 38000 assessments participated. Monochrome and colour television under 63 different test conditions was provided. The average room lighting was 0.6 foot-candles and high-light luminance 20 foot-lamberts. 21 in. receivers were employed. All pictures were from slides since observation of stills is the more critical. Co-channel, random-noise, adjacent-channel and simultaneous co-channel and random-noise interference was introduced. The form of assessment card and some of the circuitry are described.

H.G.M.Spratt

621.397.81

8346 SOUND-TO-PICTURE POWER RATIO. K.McIlwain.

Proc. Inst. Radio Engrs, Vol. 48, No. 6(I), 1097-102 (June, 1960).

In the U.S.A. the usual limitation on adjacent channel spacing of transmitters has been found to be interference from the undesired sound signal in the next lower-frequency channel. The desirability, therefore, of reducing the sound/picture ratio from 50% to possibly as low as 10% was considered by the Television Allocations Study Organization. Bearing in mind that strong sound interference is subjectively less tolerable than strong picture interference, tests were carried out on the effect of thermal and impulse noise when the sound level was so reduced. The possible cost saving in sound transmitting plant and the resulting loss in service area were also considered. The findings were inconclusive and it is suggested that the sound/picture ratio should preferably remain unchanged but that efforts should be made to improve noise figures and rejection quality of receivers. H.G.M.Spratt

621.397.828

8347 THE SIGNAL–NOISE RATIO IN THE N.T.S.C. COLOUR TELEVISION SYSTEM. N.Mayer.

Rdfunktech. Mitt., Vol. 4, No. 3, 130-9 (March, 1960). In German.

Because additional interference arises due to transmission of the colour signal, the sensitivity to sinusoidal interference above about 1 Mc/s is greater than that obtaining in black-and-white television but the results of previous investigations on the subject are widely conflicting. Signal–noise ratios were determined for a number of interfering frequencies in the video-frequency range and from one r.f. measurement. The values obtained were used to calculate those obtaining for r.f. conditions. Comparison between measured and calculated values of signal–noise ratios showed satisfactory agreement. H.G.M.Spratt

621.397.9

8348 TELEVISION SYSTEM FOR STRATOSCOPE I. L.E.Flory, G.W.Gray, J.M.Morgan and W.S.Pike.

Electronics, Vol. 33, No. 25, 49-53 (June 17, 1960).

The stratoscope is a balloon-borne telescope for high-altitude solar photography and the television transmitter installed in it is used to monitor the telescope so that the latter can be controlled remotely by ground signals. A Vidicon camera is employed and as the rate of film exposure is 1/sec, the television frame scanning rate is the same. The line-scanning rate, however, is 500/sec without interlace. Under these conditions a 200 kc/s bandwidth is adequate. Frequency modulation is employed and the 225.7 Mc/s transmitter gives an output of 10 W. A 4-element aerial of the turnstile type is provided. The airborne and ground equipment, which is almost entirely transistorized, is described in detail.

H.G.M.Spratt

621.397.9

8349 DIAL-SELECTED INDUSTRIAL TELEVISION FOR TICKET RESERVATION FACILITIES. J.W.Alinsky.

Trans Amer. Inst. Elect. Engrs I, Vol. 79, 174-7 (1960) = Commun. and Electronics, No. 48 (May, 1960).

This closed system was developed for use at a busy railway terminus. It supplies visual and verbal information from the centre where coupons representing available seats are held to: (1) the ticket counter (16 positions) where all direct sales of tickets are handled; and (2) the booths (72 positions) where reservations are taken over the telephone. Information is provided by 100 cameras at the centre and fed over a distribution system to the counters and booths. The camera resolution is not less than 400 lines/picture while at the receiving points 14 in. monitoring tubes are provided. A master synchronizing system is employed. Calling from the receiving points is effected by means of a dialling system.

H.G.M.Spratt

621.397.9

8350 REDSTONE ARSENAL CLOSED-CIRCUIT EDUCATIONAL TELEVISION SYSTEM. J.P.Argo and I.N.Howell.

Trans Amer. Inst. Elect. Engrs I, Vol. 79, 185-90 (1960) = Commun. and Electronics, No. 48 (May, 1960).

This system incorporates a master control centre receiving r.f. transmissions over aerial cable from mobile vans at 21 locations. Transmission takes place on any one of five standard v.h.f. channels. Video signals from a local studio or from four Ampex video-tape recorders can also be fed into the master control room. Selected incoming signals can be retransmitted to 29 receiving locations. If desired, they can also be transmitted by radio relay to distant cities. The aerial cable used is run about 20 ft above ground. It is an air-dielectric co-axial cable but the connection from it to the van is made through triaxial cable to provide flexibility and prevent radiation. In the operation of the system appreciable difficulty has been experienced with various forms of interference. H.G.M.Spratt

CONTROL . DATA PROCESSING

CONTROL AND SERVO SYSTEMS

621-52

8351 THE ABSOLUTE STABILITY OF CERTAIN CONTROL SYSTEMS. Yu.S.Sobolev.
Avtomat. i Telemekh., Vol. 20, No. 4, 401-5 (1960). In Russian.

621-52

8352 AN INTEGRAL CRITERION TO CHOOSE THE OPTIMUM PARAMETERS OF AUTOMATIC CONTROL SYSTEMS WITH OVERSHOOT. A.I.Tupitsyn.
Avtomat. i Telemekh., Vol. 20, No. 4, 406-14 (1960). In Russian.

A combined integral criterion is considered that permits the determination of the optimum parameters of automatic control systems when the overshoot is given. Formulae to find the approximate solution time are deduced. Some examples are presented.

621-52

8353 COMPENSATION OF A CONTINUOUS AUTOMATIC CONTROL SYSTEM BY MEANS OF A DELAY-ELEMENT FILTER. Van Sin-min [Wang Hsin-min].
Avtomat. i Telemekh., Vol. 20, No. 4, 437-46 (1960). In Russian.

The design of a delay-element filter for the compensation of continuous automatic control systems is considered. Filter parameters are determined for some examples.

621-52

8354 DETERMINATION OF TRANSFER FUNCTION COEFFICIENTS OF A LINEAR SYSTEM FROM THE INITIAL PORTION OF AN EXPERIMENTALLY OBTAINED AMPLITUDE–PHASE CHARACTERISTIC. E.E.Dudnikov.
Avtomat. i Telemekh., Vol. 20, No. 5, 576-82 (1959). In Russian.
English translation in: Automat. Remote Control, Vol. 20, No. 5, 552-8 (May, 1959: publ. Feb., 1960).

Deals with a method of determining approximate values of transfer-function coefficients of a linear system from an experimentally obtained amplitude–phase characteristic (at $\omega \to 0$). The method is applicable to delayed systems. A numerical example of determining coefficients is given.

621-52

8355 A COMPARISON OF METHODS FOR THE ANALYSIS OF PULSED LINEAR SYSTEMS. H.Freeman.
Proc. Nat. Electronics Conf., Vol. 15, 1032-43 (1959).

Pulsed linear systems may be classified as either "wide-pulse" or "narrow-pulse", depending on whether the data changes occurring during the transmission interval are significant or not. A thorough study of the properties of both types of pulsed linear systems is made and related to the development of mathematical models. It is shown that the signals can be expressed in terms of a generalized solution based on an extension of the Laplace transform.

621-52

8356 APPLICATION OF SIMULATION IN ANALYZING LINEAR PULSE SYSTEMS WITH VARIABLE PARAMETERS. G.P.Tartakovskii.
Avtomat. i Telemekh., Vol. 20, No. 5, 583-90 (1959). In Russian.
English translation in: Automat. Remote Control, Vol. 20, No. 5, 559-66 (May, 1959: publ. Feb., 1960).

Simulation of linear systems with discrete operation and variable parameters with the object of obtaining pulse response suitable for further application is examined. It is shown that a pulse response as a function of the instants when pulses are applied, can be obtained by simulating a pulse system conjugate to the original system. Methods of designing schematic circuits for conjugate pulse system models, similar to corresponding methods of simulating continuously operating systems, are derived.

621-52

8357 ON THE PROPERTIES OF THE IMPULSIVE RESPONSE FUNCTION OF SYSTEMS WITH VARIABLE PARAMETERS. V.Borskii.
Avtomat. i Telemekh., Vol. 20, No. 7, 848-55 (1959). In Russian.
English translation in: Automat. Remote Control, Vol. 20, No. 7, 822-30 (July, 1959; publ. March, 1960).

A definite class of functions of two variables is considered as to the use of their properties for solving the problem of determining a linear differential equation from a given impulsive response function, and conversely.

621-52

8358 INVARIANCE PRINCIPLE IN COMBINED AUTOMATIC CONTROL SYSTEMS. V.I.Dunaev.
Avtomat. i Telemekh., Vol. 20, No. 5, 591-4 (1959). In Russian.
English translation in: Automat. Remote Control, Vol. 20, No. 5, 567-71 (May, 1959: publ. Feb., 1960).

A further development is given of the complete invariance principle applied to combined automatic control systems with two motors driving a common load.

621-52

8359 FILTERING OF A CERTAIN TYPE OF NONSTATIONARY RANDOM VARIABLE. I.A.Boguslavskii.
Avtomat. i Telemekh., Vol. 20, No. 6, 708-20 (1959). In Russian.
English translation in: Automat. Remote Control, Vol. 20, No. 6, 685-97 (June, 1959: publ. Feb., 1960).

Deals with a method of designing a circuit for generalized unshifted signal filtering of a random function, whose useful signal is represented by the solution of a first-order linear differential equation. The coefficient of this equation consists of a function of time unknown in advance, but continuously determined in the process of filtering, and the right-hand side of the equation consists of the sum of the products of known functions and unknown quantities added to a certain function of time, which is continuously determined in the process of filtering.

621-52

8360 SEVERAL SIMPLIFICATIONS IN THE APPLICATION OF THE D-PLOT METHOD FOR DETERMINATION OF CRITICAL VALUES OF A REAL PARAMETER WHICH OCCURS LINEARLY IN THE CHARACTERISTIC EQUATION. V.A.Andreyuk.
Avtomat. i Telemekh., Vol. 20, No. 6, 823-4 (1959). In Russian.
English translation in: Automat. Remote Control, Vol. 20, No. 6, 798-9 (June, 1959; publ. Feb., 1960).

621-52

8361 A GENERAL CONDITION FOR AN EXTREMUM OF A GIVEN FUNCTION OF THE MEAN-SQUARE ERROR AND THE SQUARED MATHEMATICAL EXPECTATION OF THE ERROR OF A DYNAMIC SYSTEM. N.I.Andreev.
Avtomat. i Telemekh., Vol. 20, No. 7, 833-8 (1959). In Russian.
English translation in: Automat. Remote Control, Vol. 20, No. 7, 807-12 (July, 1959: publ. March, 1960).

The derivation is given for the condition for an extremum, and also for the greatest or least value, of some function f of the mean-square error and the squared mathematical expectation of error in approximating a random function. The general condition obtained is applied to the problem of choosing an optimal nonlinear integral operator. See also Avtomat. i Telemekh., Vol. 19, 11 (1958).

621-52

8362 A CRITERION OF CONTROL INACCURACY. Kh. V.Ruubel'.
Avtomat. i Telemekh., Vol. 20, No. 7, 856-9 (1959). In Russian.
English translation in: Automat. Remote Control, Vol. 20, No. 7, 831-5 (July, 1959; publ. March, 1960).

A theoretical basis is adduced for a criterion of control inaccuracy which allows objective comparisons to be made between different variants of automatic control systems.

621-52

8363 ON THE ANALYSIS AND SYNTHESIS OF CERTAIN ELECTRICAL CIRCUITS BY MEANS OF SPECIAL LOGICAL OPERATORS. A.D.Talantsev.
Avtomat. i Telemekh., Vol. 20, No. 7, 898-907 (1959). In Russian.
English translation in: Automat. Remote Control, Vol. 20, No. 7, 874-83 (July, 1959; publ. March, 1960).

Special logic operators are defined which describe the change in Boolean functions as their arguments change. The properties of these operators are investigated, and transformation formulae are

derived which, in many cases, allow simplification of the circuit to be synthesized. As an example, the transformation of a potential-pulse circuit used in a digital control system for a milling machine is considered.

621-52

8364 NOMOGRAMS FOR THE ANALYSIS AND SYNTHESIS OF AUTOMATIC STABILIZATION SYSTEMS.
P.S.Matveev and V.N.Piotnikov.
Avtomat. i Telemekh., Vol. 20, No. 7, 983-7 (1959). In Russian.
English translation in: Automat. Remote Control, Vol. 20, No. 7, 957-61 (July, 1959; publ. March, 1960).

Nomograms which may be used for the analysis and synthesis of automatic stabilization systems are given for the desirable logarithmic amplitude characteristics.

621-52

8365 CONTROL OF A FIRST ORDER DELAYED SYSTEM BY MEANS OF AN ASTATIC REGULATOR AND NONLINEAR CORRECTION. S.V.Emel' yanov.
Avtomat. i Telemekh., Vol. 20, No. 8, 1009-19 (1959). In Russian.
English translation in: Automat. Remote Control, Vol. 20, No. 8, 983-91 (Aug.,1959: publ. April, 1960).

A technique employing nonlinear convertors which alter the structure of delayed dynamic systems during the transient process by means of two coordinates (controlled parameter and its derivative) is proposed as a method of stabilizing and improving delayed dynamic systems described by second-order differential equations.

621-52

8366 ON DESIGNING CONTROL CIRCUITS FOR OBJECTS WITH PURE LAGS. É.L.Itskovich.
Avtomat. i Telemekh., Vol. 20, No. 8, 1047-55 (1959). In Russian.
English translation in: Automat. Remote Control, Vol. 20, No. 8, 1016-23 (Aug., 1959; publ. April, 1960).

Considers the question involved in the design of control circuits for objects with lags which are acted upon by random disturbances. Circuit design to meet given quality requirements is based upon a study of the properties of the correlation function of the quantity to be controlled. A description is given of an application of the method presented to the designing of a control circuit for one of the output quantities of a rotating-kiln cement-roasting process.

621-52

8367 STEADY-STATE PROCESSES IN THE SIMPLEST DISCRETE EXTREMAL SYSTEM WITH RANDOM NOISE PRESENT. A.A.Fel' dbaum.
Avtomat. i Telemekh, Vol. 20, No. 8, 1056-70 (1959). In Russian.
English translation in: Automat. Remote Control, Vol. 20, No. 8, 1024-38 (Aug., 1959; publ. April, 1960).

Investigation of the processes in discrete extremal systems with random noise present leads to the consideration of equivalent Markoff chains. Based on this consideration, the steady-state error and the optimal size of the step (the quantum size) in the simplest system are determined. Certain generalizations of the problem posed are considered.

621-52

8368 GENERALIZATION OF THE SHAPING FILTER METHOD TO INCLUDE NONSTATIONARY RANDOM PROCESSES. A.M.Batkov.
Avtomat. i Telemekh., Vol. 20, No. 8, 1081-94 (1959). In Russian.
English translation in: Automat. Remote Control. Vol. 20, No. 8, 1049-62 (Aug., 1959: publ. April, 1960).

Considers the basic properties of the impulsive responses of linear systems with variable parameters of general form, and the correlation functions of the random processes at their outputs when acted upon by white noise. The problem of determining the characteristics of shaping filters for this class of nonstationary processes is solved, and a method is suggested for using them in simulation problems in analysing the dynamic accuracy of systems.

621-52

8369 THE EQUATION AND CERTAIN PROPERTIES OF AN AUTOMATIC CONTROL SYSTEM'S ROOT LOCUS.
N.N.Mikhailov.
Avtomat. i Telemekh., Vol. 20, No. 8, 1095-1102 (1959). In Russian.
English translation in: Automat. Remote Control, Vol. 20, No. 8, 1063-70 (Aug., 1959; publ. April, 1960).

Considers the root locus equation for the general case of linear automatic control systems, as well as the root locus properties deriving from this equation.

621-52 : 621.395.625.3

8370 NOISE STABILITY OF CONTINUOUS PROGRAMME-CONTROLLED SYSTEMS WITH MAGNETIC RECORDING. V.N.Shadrin.
Avtomat. i Telemekh., Vol. 20, No. 8, 1111-16 (1959). In Russian.
English translation in: Automat. Remote Control, Vol. 20, No. 8, 1079-84 (Aug., 1959: publ. April, 1960).

The potential noise stability is considered for multi-channel programme-controlled systems with magnetic recording when phase modulation is used. The problem is solved for systems with weak fluctuating noise, intensity at an ideal receiver's output is found for the cases of spatial (for multi-track recording), frequency and temporal separation of the channels. A comparison is made of the noise stabilities of systems with separated channels for identical effective voltage and unit width of recording carrier.

621-52

8371 COMPUTING THE TRANSIENT RESPONSE IN LINEAR SYSTEMS BY THE METHOD OF REDUCING THE ORDER OF THE DIFFERENTIAL EQUATION. A.V.Kalyaev.
Avtomat. i Telemekh., Vol. 20, No. 9, 1171-9 (1959). In Russian.
English translation in: Automat. Remote Control, Vol. 20, No. 9, 1141-50 (Sept.,1959; publ. May, 1960).

621-52

8372 ON DESIGNING CORRECTING CIRCUITS FOR AUTOMATIC CONTROL SYSTEMS IN ACCORDANCE WITH THE MEAN SQUARE ERROR CRITERION. V.I.Kukhtenko.
Avtomat. i Telemekh., Vol. 20, No. 9, 1180-7 (1959). In Russian.
English translation in: Automat. Remote Control, Vol. 20, No. 9, 1151-9 (Sept. 1959; publ. May, 1960).

A method is presented for finding the optimal (in the sense of minimum mean square error) transfer function, the degree of whose numerator is a given number of units less than the degree of the denominator. A discussion is given of the relationship of this question with the question of physical realizability of the correction circuit. An example is provided.

621-52 : 621.372.5

8273 CALCULATION OF THE STEP-RESPONSE FUNCTION FROM THE MODULUS OF THE TRANSFER FUNCTION.
G.Wunsch.
Frequenz, Vol. 14, No. 7, 244-7 (July, 1960). In German.

In the system theory introduced by Küpfmüller, certain assumptions are made which cannot be justified for a physically realizable system. It is shown that the theory can be generalized in such a way that this objection is removed. V.G.Welsby

621-52 : 681.142

8374 FACTORS INFLUENCING THE DESIGN OF A SOLID STATE ANALOG CONTROL SYSTEM. R.L.Nelson.
I.R.E. Trans Industr. Electronics, Vol. IE-7, No. 1, 6-12 (March, 1960).

Discusses the economic and practical considerations of analogue industrial control equipment based on operational amplifiers, leading to the choice, in this case, of a magnetic amplifier. Simple diagrams are given, showing how elementary control functions are obtained. K.C.Garner

621-52

8375 ANALYSIS AND DESIGN OF FEEDBACK SYSTEMS WITH GAIN AND TIME CONSTANT VARIATIONS.
Kan Chen.
I.R.E. WESCON Convention Record, Vol. 4, Pt 2, 102-8 (1960).

The design of a feedback control system containing an element with proportional variation of gain and time-constant is a common problem encountered in practice. The problem includes the stabilization of a system, which is open-loop unstable when both the gain and the time constant of the element are negative. A method for analysing the transient response of systems containing the aforementioned element, and designing the systems to meet transient specifications is presented.

621-52

8375 MEASURES OF SENSITIVITY FOR LINEAR SYSTEMS WITH LARGE MULTIPLE PARAMETER VARIATIONS.
S.L.Hakimi and J.B Cruz, Jr.
I.R.E. WESCON Convention Record, Vol. 4, Pt 2, 109-15 (1960).

The problem considered is the characterization of the deviation of a system function when the element values are allowed to deviate from the designed or nominal values. It is shown that it is possible for the system function deviation to decrease as the element value deviations increase so that it is not sufficient to examine the system function only when the element values attain maximum or minimum values as specified by their tolerances. Upper and lower bounds on the transmission or system function are obtained for all possible combinations of element deviations within specified tolerance limits. The principal method for carrying these out involves a theorem due to Myers. In the second half of the paper, the element deviations are assumed to be random variables. Uniform and normal probability density functions are considered for these random variables. Instead of determining bounds on the transmission function as in the first part, a pseudo-Monte Carlo method is used for determining an r.m.s. system function deviation. From the necessarily finite number of random sets of element deviations used in a digital computer calculation, the largest and smallest system function obtained may be used as guides in resetting the element tolerances to meet specifications on the system function deviation.

621-52

8377 A SAMPLED-DATA TECHNIQUE FOR REALIZING NETWORK TRANSFER FUNCTIONS.
L.E.Franks and I.W Sandberg.
I.R.E. WESCON Convention Record, Vol. 4, Pt 2, 116-22 (1960).

A sampled-data network is described which consists of a parallel combination of n paths, each path containing a linear, time-invariant network and input and output sampling devices. This network is representative of a class of interesting time-varying networks that can be characterized by a transfer function which is essentially periodic over a bandwidth proportional to n, the number of parallel paths. Periodic characteristics are normally associated with networks containing distributed elements. Accordingly, the sampled-data filter provides an attractive alternate realization technique for network functions which would normally require delay line elements, especially at frequency ranges where delay lines are impractical circuit elements. It is shown that the transfer function consists of a sequence of frequency-translated versions of the transfer function of the linear, time-invariant networks in the individual paths. This property has been used for the realization of highly selective bandpass filtering characteristics without the use of inductors. Some specific circuit applications exploiting these transfer function properties are described and experimental results are given.

621-52

8378 A SIMPLIFIED TECHNIQUE OF ESTIMATING STEADY STATE PERFORMANCE OF ON-OFF CONTROL SYSTEMS. S.Minagawa.
Mem. Fac. Engng Nagoya Univ., Vol. 11, No. 1-2, 153-9 (Nov., 1959).

A technique is introduced for estimating rapidly the steady-state performance of a second order on–off control system having a symmetric on–off controller without dead zone and whose switching line is symmetrical with respect to the origin of the phase plane. By superposing the virtual switching lines, drawn on transparent paper, over a real switching line, the oscillatory condition of the system could be revealed. S.C.Dunn

621-52

8379 SYNTHESIS OF LINEAR, MULTIVIBRATOR FEEDBACK CONTROL SYSTEMS. I.M.Horowitz.
Proc. Nat. Electronics Ccnf., Vol. 15, No. 276-89 (1959).

A multivariable controlled process or plant is one in which there are n independent inputs and m outputs with $n > 1$ and $m \leq n$. A control problem may exist for one or two principal reasons: (1) the plant parameters may vary or they may be only vaguely known and the system response sensitivity to the parameter variation is to be reduced; (2) the system response to disturbances is to be reduced. A synthesis procedure for attaining these objectives and simultaneously realizing a desired set of system transmission functions is developed. The role of system configuration is considered. Design is broken up into two separate regions. In the significant system-response frequency region, there is straightforward synthesis in attaining the design objectives. In the higher frequency range, the loop transmission must be shaped so that the system is stable. The latter problem is considerably more difficult when there are substantial plant parameter variations. The procedure is illustrated by a detailed example ($n = 3$, $m = 2$) in which there are large plant parameter variations.

621-52

8380 AN EXTENSION OF PHASE-PLANE ANALYSIS TECHNIQUES TO A THREE DIMENSIONAL PHASE-SPACE. L.P.Grayson and E.Mishkin.
Proc. Nat. Electronics Conf., Vol. 15, 310-21 (1959).

The geometrical properties of the singular points encountered in the study of secod-order nonlinear control systems, in the phase-plane, are extended to third-order systems, in a three dimensional phase-space. Single-valued nonlinear systems are analysed by piecewise linearization techniques; i.e., the nonlinearities in the system are approximated by a series of straight line segments, so that the system is linear within certain regions. Phase-plane projections, as well as three dimensional sketches, of the trajectories corresponding to the different types of singular points encountered are given. Relationships are established between the pole positions, in the corresponding linear systems, and the singular points. The singular points developed are: a stable and an unstable centre, a stable and an unstable node, a saddle point, a stable and an unstable focus, and a stable and an unstable degenerate focus.

621-52

8381 IMPROVEMENT OF PRECISION CONTROL USING OPEN LOOP METHODS. L.J.Johnson and S.E.Rauch.
Proc. Nat. Electronics Conf, Vol. 15, 1066-71 (1959).

Presents arguments with examples showing how the direct application of a physical phenomenon as a standard can produce controlled accuracies normally higher that that obtained by feedback control methods. The open loop methods presented provide a simplification in synthesis and analytical design. The major benefit to be obtained is a simplified direct approach towards obtaining higher degrees of precise control without meeting the difficulties of instability often encountered in feedback control design. A new control system is discussed which shows improvements in accuracies of several orders of magnitude over the obtainable limits of comparable feedback control techniques.

621-52

8382 TRENDS IN ADAPTIVE CONTROL SYSTEMS. J.G.Truxal.
Proc. Nat. Electronics Conf., Vol. 15, 1-16 (1959).

An adaptive feedback control system is defined (in contrast to the conventional feedback system) as a configuration in which the measurement of process dynamics or signal characteristics is utilized to adjust automatically the controller in an attempt to achieve optimum operation at all times. Although adaptivity is essentially a viewpoint in analysis and design, a variety of novel feedback systems has resulted from the early years of research in adaptive systems. The ultimate goal of adaptive control is described as a feedback system which, by possessing an adaptivity with a high-order learning mechanism, is competitive with a human controller in a significant variety of specific tasks.

621-52

8383 MULTIDIMENSIONAL ADAPTIVE CONTROL. J.E.Gibson and E.S.McVey.
Proc. Nat. Electronics Conf., Vol. 15, 17-26 (1959).

A definition of adaptive control is given. The three requirements for an ideal adaptive system are listed. The concept of multidimesional adaptation is brought out. Consideration is given to the mathematical problems of methods of steep descent in multidimensional adaptation. Finally, a laboratory model of a restricted multidimensional adaptive control is discussed and test results are compared with an idealized digital computer model. The responses are presented for operation with and without the addition of external disturbances and noise.

621-52

8384 ON THE PHILOSOPHY OF ADAPTIVE CONTROL FOR PLANT ADAPTIVE SYSTEMS.
M.Margolis and C.T.Leondes.
Proc. Nat. Electronics Conf., Vol. 15, 27-33 (1959).

Describes a very general approach to the design of process

adaptive systems. First, a brief look is taken at the development of feedback control theory and practice. Process adaptive control is then discussed as a logical extension of the basic concepts of feedback theory. A particular mechanism for process adaptive control is suggested. This mechanism makes use of a learning model whose form is the same as the physical process and whose parameters are continually adjusted so that the model and process behave as much alike as possible. The parameters of the model are used to set the parameters of the controller for the overall control of the system.

621-52

8385 USE OF CROSSCORRELATION IN AN ADAPTIVE CONTROL SYSTEM.
G.W.Anderson, R.N.Buland and G.R.Cooper.
Proc. Nat. Electronics Conf., Vol. 15, 34-45 (1959).

The measurement of system impulse response by means of crosscorrelation is discussed. The use of periodic excitation and the effects of external disturbances are considered. Several methods of applying response measurements to self-adaptive systems are described and one method is illustrated by an adaptive aircraft pitch damper in which relative stability is controlled. The mechanization of a practical crosscorrelator is also discussed.

621-52

8386 OPTIMIZING LINEAR DYNAMICS FOR HUMAN-OPERATED SYSTEMS BY MINIMIZING THE MEAN SQUARE TRACKING ERROR. T.E.Leonard.
I.R.E. WESCON Convention Record, Vol. 4, Pt 4, 57-62 (1960).

Describes the use of a minimum mean square tracking error criterion to establish linear control system dynamics that are best suited for human control. It is shown that trained humans often adopt compensation dynamics that result in minimum mean square tracking error. Methods are given for determining approximate linear human behaviour or for determining desirable compensation dynamics by minimizing the mean square tracking error.

621-52

8387 ON APPROXIMATE SYNTHESIS OF OPTIMUM LINEAR DETECTING SYSTEMS. Yu.P.Leonov.
Avtomat. i Telemekh, Vol. 20, No. 8, 1071-80 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 8, 1039-48 (Aug., 1959; publ. April, 1960).

Deals with the approximate solution of the integral equation for the weighting function of the optimum system.

621-52

8388 THE PROBLEM OF OPTIMIZING SYSTEMS WHICH CONTAIN ESSENTIALLY NONLINEAR ELEMENTS.
E.P.Merkulova.
Avtomat. i Telemekh., Vol. 20, No. 10, 1335-44 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 10, 1303-13 (Oct., 1959: publ. June, 1960).

A method is given for finding the optimal weight function of the linear portion of a stationary system which contains an arbitrary number of essentially nonlinear elements. The problem is solved for various methods of connecting the linear portions and the nonlinear elements. The input is a stationary random function of time consisting of signal plus noise. The linearization of the nonlinear elements is carried out by a statistical method.

621-52

8389 OPTIMAL CONTROL OF AN OBJECT WITH TWO CONTROLLING STIMULI. E.A.Rozenman.
Avtomat. i Telemekh., Vol. 20, No. 10, 1345-9 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 10, 1314-18 (Oct., 1959: publ. June, 1960).

The problem considered is that of the optimal transient response in an object at whose input the product of two independent controlling functions act, namely, an electric motor controlled by independent variation of armature current and excitation current. It is shown that the extremals are combinations of δ-functions.

621-52

8390 L.S.PONTRYAGIN'S MAXIMUM PRINCIPLE IN THE THEORY OF OPTIMUM SYSTEMS. I. L.I.Rozonoér.
Avtomat. i Telemekh., Vol. 20, No. 10, 1320-34 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 10, 1288-1302 (Oct., 1959; publ. June, 1960).

Questions are discussed which are associated with the proof and use of the Pontryagin maximum principle in the theory of optimum systems. The work also contains some new results. The problem of optimization for the case of a free right end of a trajectory is examined. The maximum principle is then formulated for boundary conditions of a more general type. The connection between the method of dynamic programming and the maximum principle is established; a method of solving optimization problems in linear discrete systems is given, and a number of considerations concerning the use of the maximum principle in the solution of a definite class of problems associated with the theory of dynamic accuracy of control systems are also discussed.

621-52

8391 OPTIMUM TRANSIENT PROCESSES IN SYSTEMS WITH A RESTRICTED THIRD DERIVATIVE.
A.A.Pavlov.
Avtomat. i Telemekh., Vol. 20, No. 8, 1020-36 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 8, 992-1007 (Aug., 1959; publ. April, 1960).

Optimum transient processes in a system with a restricted third derivative of the controlled variable are examined. The form of optimum transient processes due to step disturbances is determined and a possible method of synthesizing the optimum controlling part of the system is given.

621-52

8392 OPTIMIZATION OF NON-LINEAR CONTROL SYSTEMS WITH TRANSIENT INPUTS. A.T.Fuller.
J. Electronics and Control, Vol. 8, No. 6, 465-79 (June, 1960).

The nature of the optimum controller is investigated for control systems which are subject to saturation. It is shown that for a wide class of performance criteria the optimum controller simply generates an instantaneous non-linear function of the input phase coordinates and of the output phase coordinates. For relay control systems, the optimum controller is characterized by a switching surface in the phase space. For special cases, the dimensions of the phase space can be reduced in number by using error coordinates. These results systematize and generalize several known results, and explain the starting points of some recent abstract papers.

621-52

8393 OPTIMIZATION OF NON-LINEAR CONTROL SYSTEMS WITH RANDOM INPUTS. A.T.Fuller.
J. Electronics and Control, Vol. 9, No. 1, 65-80 (July, 1960).

It is shown that for a wide class of saturating control systems with random inputs, the optimum controller is an instantaneous non-linear function of the input phase coordinates and the output phase coordinates. If the system is a relay control system, the optimum controller is represented by a switching surface in the corresponding phase space. In special cases the otpimum controller can be simplified by the use of error phase coordinates. These results are applicable when the random input is a generalized Markov process, a Gaussian process, or a Gaussian signal plus a Gaussian noise. The synthesis of the optimum switching surface by a self-optimizing technique is discussed. See also preceding abstract.

621-52

8394 ON THE ANALYSIS OF THE STABILITY OF THE PERIODIC MODES OF OPERATION IN NONLINEAR CONTROL SYSTEMS WITH MANY DEGREES OF FREEDOM.
A.Taft.
Avtomat. i Telemekh., Vol. 20, No. 9, 1163-70 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 9, 1132-40 (Sept. 1959: publ. May, 1960).

On the basis of a generalized corollary of Hilf's equation, a derivation is given of the characteristic equation (in finite form) of a system with many degrees of freedom whose parameters are periodic functions of time. The results obtained permit the use of the well-known Mikhailov criterion for analysing the stability of the periodic modes of operation.

621-52

8395 THE USE OF NONLINEAR CORRECTING DEVICES OF THE "KEY" TYPE FOR IMPROVING THE QUALITY OF SECOND-ORDER AUTOMATIC CONTROL SYSTEMS.
S.V.Emel'yanov.

Avtomat. i Telemekh., Vol. 20, No. 7, 867-83 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 7, 844-59 (July, 1959; publ. March, 1960).

Deals with the questions of stabilization and improvement of regulation quality of linear second-order control systems by means of nonlinear correcting devices of the "key" type.

621-52

8396 A STABILITY CRITERION FOR NONLINEAR CONTROL SYSTEMS. Chzhan Sy-in [Chang Ssŭ-ying].
Avtomat. i Telemekh., Vol. 20, No. 5, 669-72 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 5, 639-43 (May, 1959: publ. Feb., 1960).

621-52

8397 SOME SIMPLIFIED STABILITY CRITERIA FOR NONLINEAR CONTROL SYSTEMS. A.K.Bedel'baev.
Avtomat. i Telemekh., Vol. 20, No. 6, 689-701 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 6, 664-78 (June, 1959: publ. Feb., 1960).

Certain simplified stability criteria which do not require preliminary canonization of their initial equations are given for non-linear control systems.

621-52

8398 STABILITY OF NONLINEAR CONTROL SYSTEMS. E.N.Rozenvasser.
Avtomat. i Telemekh., Vol. 20, No. 6, 702-7 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 6, 679-84 (June, 1959: publ. Feb., 1960).

Certain circumstances which provide the possibility of extending the sphere of application of the method proposed by Lur'e [Some Linear Problems of the Theory of Automatic Control. Moscow: Gostekhizdat (1951)] for investigating the stability of controlled systems are outlined.

621-52 : 621.375.3

8399 CALCULATION OF STATIC CHARACTERISTICS OF REACTOR [(MAGNETIC AMPLIFIER)] CONTROL SYSTEMS. D.A.Alenchikov.
Avtomat i Telemekh., Vol. 20, No. 5, 595-605 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 5, 572-81 (May, 1959: publ. Feb., 1960).

Graphical methods for the solution of nonlinear problems which are encountered in the design of complex reactor control systems are set forth. A graphical method is given for plotting the path of the operating point (p.o.p.) of a saturable reactor, taking into account as a first-order approximation, the losses in the saturable reactor, depending on the operating current and the voltage drop in the saturable reactor. Methods of plotting the output load characteristics are described in detail. For this it is proposed to augment the p.o.p. by functional relationships between one of the output quantities and the specific current in the working windings. As a result, it turns out to be possible to determine directly the characteristics of output quantities for fixed values of the SR control current. A method is proposed for determining initial data for the choice or the design of a controller in the case when the law governing the mutual variations of the saturable reactor's output load quantities is known.

621-52

8400 ON THE STABILITY OF A RELAY SYSTEM'S EQUILIBRIUM STATE. S.D.Kinyapin and Yu.I.Neimark.
Avtomat. i. Telemekh., Vol. 20, No. 9, 1153-62 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 9, 1121-31 (Sept., 1959; publ. May, 1960).

621-52

8401 THE CALCULATION OF PERIODIC MODES IN RELAY-TYPE AUTOMATIC CONTROL SYSTEMS. Yu.I.Alimov.
Avtomat. i Telemekh., Vol. 20, No. 7, 860-6 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 7, 836-43 (July, 1959; publ. March, 1960).

Exact methods are employed in the investigation of periodic modes in automatic control systems which consist of relay elements, linear links and inertialess functional transformers which do not appear in supplementary feedback loops and which are not shunted by them.

621-52

8402 ON THE ERROR OF A LINEAR INTERPOLATOR FOR A PROGRAMME-CONTROLLED DIGITAL SYSTEM. V.V.Karibskii.
Avtomat. i Telemekh., Vol. 20, No. 6, 748-55 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 6, 725-32 (June, 1959: publ. Feb., 1960).

The principles of operation of a digital linear interpolator are described, and a theoretical investigation of interpolation error is made. A general expression for this error is derived, and an estimate is made of the maximum possible absolute value of this error.

621-52

8403 EXPERIMENTAL DETERMINATION OF AUTOMATIC CONTROL SYSTEM LINKS' TRANSFER FUNCTIONS BY MEANS OF STANDARD ELECTRONIC MODELS. L.N.Darovskikh.
Avtomat. i Telemekh., Vol. 20, No. 9, 1209-16 (1959). In Russian. English translation in: Automat Remote Control, Vol. 20, No. 9, 1180-7 (Sept. 1959; publ. May, 1960).

A method is suggested for determining the coefficients of transfer functions by means of standard electronic models (analogues). A table is provided which allows one to set up a system of linear algebraic equation for computing the coefficients of the transfer function with or without a polynomial in the numerator, and also when there is only a polynomial in the numerator. Examples of the application of this method are given.

621-52

8404 A METHOD OF SYNTHESIZING LINEAR SAMPLED-DATA AUTOMATIC CONTROL SYSTEMS TO ACCORD WITH DYNAMIC CRITERIA. L.N.Volgin.
Avtomat. i Telemekh., Vol. 20, No. 10, 1350-6 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 10, 1319-26 (Oct., 1959; publ. June, 1960).

A method of synthesizing sampled-data systems is proposed. The transfer function of a system is written as the product of the so-called "minimal polynomial", to which the given portion of the system is reduced, by an artificial portion which is introduced in order to obtain the desired quality. The method permits the use of a digital computer for the design of linear sampled-data automatic control systems.

621-526 : 681.142

DISCRETE ANALOGUE-COMPUTER COMPENSATION OF SAMPLED-DATA CONTROL SYSTEMS. See Abstr. 8512

621-52

8405 THE SAMPLING PRINCIPLE IN CONTROL ENGINEERING. H.Weingarten.
Wiss. Z. Tech. Hochsch. Dresden, Vol. 8, No. 3, 500-4 (1958-59). In German.

Shannon's sampling theorem is reviewed as the basis of all sampling data-processing systems. Pulse-amplitude, pulse-width, pulse-frequency and pulse-code modulation are described for the understanding of analogue-to-digital convertors. Their connection in control circuits is analysed and the function of the demodulator, i.e., the digital-to-analogue convertor, as a process of interpolation is explained. A digital interpolation circuit is described in detail.

E.Erdélyi

621-52 : 681.42

8406 DESIGN OF CONTINUOUS LINEAR CONTROL SYSTEMS FOR MINIMUM PROBABILISTIC ERROR. J.Zaborszky and J.W.Diesel.
Trans Amer. Inst. Elect. Engrs II, Vol. 79, 44-54 (1960) = Applic. and Industr., No. 48 (May, 1960).

The probabilistic error is used as a universal error criterion, and is an averaged and penalized error, taking into account the nature of all inputs to the system, and the load changes, whether stationary or non-stationary random, step, impulse, sinusoidal, or other deterministic forms, and only effective when the system output is being utilized. Thus it includes as special cases, mean-square, integral-square, and other special error criteria. The introduction to this concept was given in a previous paper, (see Abstr 6881 of 1959). Now the method is completely generalized to include all linear systems with any or all the above mentioned inputs and load variations. The treatment is highly theoretical, and

developed in tabular form from which it is possible to construct digital computer programmes for the solution of the appropriate functional relationships derived. Much use is made of orthogonal or orthonormal functions in trigonometrical, exponential, and modified Legendre form, and numerical tables are provided for the modified Legendre coefficients. A relatively simple numerical example is given, and two appendices provide certain solutions required in the main text. K.C.Garner

621-52 : 681.42

8407 DESIGN OF SAMPLED-DATA CONTROL SYSTEMS FOR MINIMUM PROBABILISTIC ERROR.
J.Zaborszky and J.W.Diesel.
Trans Amer. Inst. Elect. Engrs II, Vol. 79, 54-62 (1960) = Applic. and Industr., No. 48 (May, 1960).

The theory described in other papers (see Abstr. 6881 of 1959 and preceding abstract) is extended to provide optimum synthesis for sampled-data systems. In general an optimum linear digital filter is derived. Solutions, although general enough, are stated to be less easy to obtain if the output is utilized over a time interval containing an excessive number of samples. As before, tables of input functions etc., are provided to assist programming for a digital computer. Four theoretical appendices are included.
K.C.Garner

621-52 : 681.142

8408 DESIGN FOR MINIMUM PROBABILISTIC ERROR OF CONTINUOUS LINEAR CONTROL SYSTEMS SUBJECT TO CONSTRAINTS. J.Zaborszky and J.W.Diesel.
Trans Amer. Inst. Elect. Engrs II, Vol. 79, 63-6 (1960) = Applic. and Industr., No. 48 (May, 1960).

The theory described in other papers (see Abstr. 6881 of 1959 and preceding abstracts) is extended to include the case of constraints on the system output. Specifically, an acceleration limit is considered. Theoretical equations are presented in an orderly sequence to assist digital computer programming. K.C.Garner

621-52 : 681.142

AUTOMATIC TEST EQUIPMENT CHECKS MISSILE SYSTEMS. See Abstr. 8479

621-52 : 681.142 : 621.393.933.23

8409 INVESTIGATION OF THE FEASIBILITY OF DESIGNING HOMING AIRCRAFT FLIGHT CONTROL SYSTEMS FOR MINIMUM PROBABILISTIC ERROR. J.Zaborszky and J.W.Diesel.
Trans Amer. Inst. Elect. Engrs II, Vol. 79, 66-70 (1960) = Applic. and Industr., No. 48 (May, 1960).

A simplified single-plane missile homing situation considering perturbations about a constant-bearing course is considered, where the missile transfer function is regarded as fixed, or at least slightly adaptive. The theory discussed in other papers (see Abstr. 6881 of 1959 and preceding abstracts) is applied somewhat descriptively, to indicate how such a system, with its random target motion, noise, and initial errors, can be applied to determine an optimum control system that provides a minimum probabilistic error. K.C.Garner

621-52

8410 ON THE APPLICATION OF THE DESCRIBING FUNCTION TO THE EXAMINATION OF THE STABILITY OF A SAMPLER-REGULATOR. W.Oppelt.
Regenlungstechnik, Vol. 8, No. 1, 15-18 (Jan., 1960). In German.

The transient response of the sampler and hold circuits to a sinusoidal input is represented by the fundamental component of the Fourier expansion of the response. This enables the amplitude- and frequency-dependent gain components to be plotted separately on the complex gain plane (a modification of the Nyquist Locus) for sampled data control systems. Such an approximation technique enables the order of stability of such a system to be obtained.
J.W.Gardner

621-52

8411 EXTENDED SYNTHESIS TECHNIQUES FOR MULTIPOLE SAMPLED-DATA CONTROL SYSTEMS.
E.B.Stear and C.T.Leondes.
Proc. Nat. Electronics Conf., Vol. 15, 299-309 (1959).

Deals with the presentation of a logical and efficient procedure for the synthesis of multipole sampled-data control systems. It is assumed that the specifications on the system are stated in the time domain, and this is in fact a common situation. Furthermore, it is not assumed in the synthesis procedure presented that the specifications are stated only at the sampling instants of the system, but rather at arbitrary and necessary instants of time. In addition to this, a lower bound is established for the sampling rate based on system requirements. This last exceedingly important aspect has received very little attention in the literature.

621-52

8412 OPTIMUM CONTROL THROUGH TUNED SAMPLING. J.T.Tou.
Proc. Nat. Electronics Conf., Vol. 15, 290-8 (1959).

The optimum control of sampled-data systems by making use of tuned sampling is considered. A sampled-data control system contains one or more samplers which may operate with different sampling rates. The sampling rate may be either constant or variable. It is found that the control system exhibits optimum performance if the variable-rate sampler is properly "tuned". The system stability may be improved by selecting a suitable variable rate for the sampler. It is shown that when the cyclic-variable sampling rate is varied the stability boundary describes a curve which is concave downward, exhibiting a peak between two limiting values of the cyclic rate. Furthermore, when the system is subjected to a stochastic input, the mean-square error can be reduced to a minimum by "tuning" the variable-rate sampler to an optimum rate. The optimizing feature of tuned sampling may be utilized to achieve self-optimization of control systems.

621-52

8413 SYNTHESIS OF SAMPLED-DATA CONTROLLERS IN MULTI-VARIABLE CONTROL SYSTEMS.
F.Nishida and M.Imai.
Mem. Fac. Industr. Arts Kyoto Tech. Univ. (Sci. Technol.), No. 8, 21-38 (1959).

The analysis and synthesis of the above systems are discussed using matrix methods of solution. To achieve physical realizability, restraints are reduced to a minimum. The usefulness of a different approach to fast-response systems is considered. Optimum design methods for random input disturbances are investigated by a statistical approach. Solution of different equations using the z-transform is demonstrated in an appendix. T.Horrocks

621-52

8414 SYNTHESIS FOR FINITE SETTLED TIME RESPONSE IN SAMPLED-DATA CONTROL SYSTEMS WITH NON-LINEARITY. M.Sato and K.Nakamura.
Mem. Fac. Engng Nagoya Univ., Vol. 11, No. 1-2,143-52 (Nov., 1959).

The systems considered contain simple devices, a discrete compensator, hold circuit and a controlled object having nonlinear characteristics, such as saturation, dead zone and hysteresis, and disturbances at the final actuator. It is shown that compensation for the latter is equivalent to compensation for nonlinear characteristics at the same place when the nonlinear effects are replaced by equivalent disturbances determined by the order of the hold circuit. It is shown to be particularly effective in the case of saturating systems to use a compensating element of a similar character. By this means, the hunting phenomenon usually observed when the control system is delayed or is of high order is avoided.
S.C.Dunn

621-52 : 621.317.34

MEASUREMENT OF THE MEAN SQUARE VALUE OF CERTAIN RANDOM SIGNALS. See Abstr. 7431

621-52 : 681.142

ANALOGUE STUDY OF A DENSITY REGULATING SYSTEM IN A HYDROMETALLURGICAL PROCESS.
See Abstr. 8516

621-52 : 621.39

8415 RANDOM PROCESSES IN CONTROL AND COMMUNICATIONS. R.F.Drenick.
Science, Vol. 132, 865-70 (Sept. 30, 1960).

621-526

8416 FREQUENCY SPECTRUM DISTORTION OF RANDOM SIGNALS IN NON-LINEAR FEEDBACK SYSTEMS.
J.C.West, J.L.Douce and B.G.Leary.
Proc. Instn. Elect. Engrs, Monogr. 419 M, publ. Nov., 1960, 6 pp. To be republished in Part C.

Considers the distortion introduced by torque saturation in a servomechanism when responding to a randomly varying input signal, with emphasis on the spectral distribution of this distortion. It is shown that low-frequency errors are produced by the application of an input signal whose spectrum extends beyond the pass band of the system. An approximate expression is derived which enables the magnitude of the low-frequency errors to be evaluated in a simple manner. Experimental results are presented for a particular system.

621-526

8417 SYNTHESIS OF SERVOSYSTEM CORRECTING DEVICES IN THE PRESENCE OF NOISE. P.S.Matveev.
Avtomat. i Telemekh., Vol. 20, No. 6, 721-8 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 6, 698-705 (June, 1959: publ. Feb., 1960).

Results provided previously [Avtomat. i Telemekh., Vol. 16, No. 3 (1955)] are summarized for the case where signals are applied to two elements of a servosystem and for systems of automatic stabilization. The suggested method is illustrated by an example.

621-526

8418 ON THE SYNTHESIS OF PULSED CORRECTING DEVICES FOR SERVOSYSTEMS. A.A.Krasovskii.
Avtomat. i Telemekh., Vol. 20, No. 6, 729-39 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 6, 706-17 (June, 1959; publ. Feb., 1960).

Optimal distributions are determined for the weighted coefficients of closed servosystems for the case where the signal is slowly varying and the noise is of an arbitrary stationary random nature, and also for the case where the signal is random and stationary. Formulae are derived for values of the coefficients of a linear pulsed correcting device corresponding to the given weighted coefficients of a closed system.

621-526

8419 A.C. SERVO SYSTEMS IN WHICH THE SIGNAL DEPENDS ON THE ERROR AND ITS DERIVATIVE.
N.P.Vlasov.
Avtomat. i Telemekh., Vol. 20, No. 10, 1357-65 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 10, 1327-34 (Oct., 1959; publ. June, 1960).

It is assumed that the signal depends on the error and on the speed with which the error changes. The transmission function for a linear four-terminal network and for servo systems which are stabilized by differentiating four-terminal networks and velocity feedback are obtained.

621-526

8420 DETERMINATION OF THE LIMIT OF THE STABLE DOMAIN IN PARAMETRIC SPACE. II. M.A.Ajzerman.
Automatisme, Vol. 5, No. 7-8, 273-8 (July-Aug., 1960). In French.

For Pt I, see Abstr. 4542 of 1960. The argument followed in Part I is extended in specific examples. The parametric space is divided into regions in which there is a specified number of roots with negative real parts. The number of such roots determines the system stability. This is followed by similar considerations where two parameters are involved. The stability of the system is now dependent on certain discriminants. The parametric space now has the values of the two parameters as axes (instead of the real and the complex parts of one parameter as before). Stability regions are again obtained. T.Horrocks

621-526 : 681.142

8421 STUDY AND ADJUSTMENT OF A SERVOMECHANISM WITH THE AID OF AN ANALOGUE COMPUTER.
M.Fourquet and J.Berigaud.
Automatisme, Vol. 5, No. 7-8, 279-83 (July-Aug., 1960). In French.

Electronic analogue computers can be used in three ways for analysing servomechanisms; namely for the solution of linear system equations, for nonlinear equation solutions and by inserting the servo elements themselves in the computer set up. Studies employing all three methods simultaneously have been made on an aircraft engine stabilizing system and are described as an example of a method which may be applied to systems in general. Nonlinearities brought about by saturation of system components are introduced analogously whilst the governor motor and its associated relay system are inserted in the computer circuit, care being taken to match real and simulated quantities. A.S.Hay

621-526

8422 NUMERICAL-GRAPHICAL METHODS OF CALCULATING TRANSIENT PROCESSES FOR GIVEN STRUCTURAL CIRCUITS. A.M.Suchilin.
Elektrichestvo, 1960, No. 7, 35-9 (July). In Russian.

Simplifies, generalizes and develops a numerical equivalent to Basharin's graphical method (Leningrad Univ., 1956). In analogy with the structural circuit and its typical dynamic network, the concept is introduced here of a programme design circuit consisting of typical elementary networks, each of which has its own elementary programme design circuit. These last circuits are defined by obtaining recurrence formulae for numerical computation of the transients in each network of the structural circuit. The recurrence formulae are based on the transmission functions of the networks, which are tabulated as linear and nonlinear inertial, differentiating with and without inertial index, and integrating. The method is applicable to any dynamic system e.g. automatic control, electric circuits and servomechanisms. D.E.Brown

621-526

8423 APPLICATION OF THE STANDARD FORMS IN THE SYNTHESIS OF LINEAR SERVOMECHANISMS.
Z.Dráb.
Slaboproudy Obzor, Vol. 21, No. 7, 393-7 (1960). In Czech.

The synthesis by means of the standard forms is based on the principle, that for a given type of servomechanism (with prescribed behaviour in the steady state, a given number of time constants, etc.) it is possible to choose a suitable standard transfer function which gives a desired transient response. This method has certain drawbacks and it is, therefore, suggested that the synthesis should be based on determining directly the dependence of the shape of the transient on the distribution of the roots of the transfer function in the complex plane (see Abstr. 1922 of 1960). In practice, the determination of the standard forms can be difficult and laborious and it is advisable to employ suitable analogues (electrolytic tank or a differential analyser) for this purpose. R.S.Sidorowicz

621-526

8424 INPUT–OUTPUT CROSS-CORRELATION FUNCTIONS FOR SOME MEMORY-TYPE NONLINEAR SYSTEMS WITH GAUSSIAN INPUTS. H.R.Leland.
Trans Amer. Inst. Elect. Engrs II, Vol. 79, 219-23 (1960) = Applic. and Industr., No. 49 (July, 1960).

The method of quasilinearization reported in an earlier paper (see Abstr. 4439 of 1959) is extended to systems in which there is a hysteresis element. This element is represented by a first-order lag element. Cross-correlation functions predicted by the method were verified by analogue computer simulation. W.G.Stripp

621-526

8425 AN ENGINEER'S APPROACH TO A SERVO PROBLEM. H.Clausen.
Trans Soc. Instrum. Technol., Vol. 12, No. 1, 1-16 (March, 1960).

A plea for more practical investigation of motor characteristics, measurement of yields, gear backlash etc. Graphical methods of analysis and solution of differential equations are reviewed. W.G.Stripp

621-526

8426 LEARNING IN CONTROL SYSTEMS. A.M.Andrew.
Control, Vol. 3, 99-103 (Sept., 1960).

A review of developments in conditional probability computers and self-optimizing control systems, with suggestions on possible advances, and 24 references. W.G.Stripp

621-526

8427 POLARIZED-RELAY VIBRATION CONTROL BLOCK FOR PNEUMATIC DRIVES.
N.S.Gorskaya and B.I.Myzin.
Avtomat. i Telemekh., Vol. 20, No. 7, 982-8 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 7, 966-72 (July, 1959: publ. March, 1960).

A polarized-relay vibration control block designed to operate with pneumatic drives is considered. The basic requirements imposed on the vibration control blocks of pneumatic drives, at whose outputs auto-oscillations are inadmissible, are formulated, the characteristics of the block are given, as well as oscillograms of the transient responses in the individual portions of the control block. The results of tests in a complete servomechanism in conjunction with a pneumatic drive are presented.

621-526 : 621.313.333

8428 ON THE TRANSFER FUNCTION OF AN ASYNCHRONOUS TWO-PHASE MOTOR. V.G.Kutvinov.
Avtomat. i Telemekh., Vol. 20, No. 7, 928-38 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 7, 902-12 (July, 1960; publ. March, 1960).

Considers the special features inherent in the determination of the coefficients of the transfer function of a motor for amplitude and phase modulation. An engineering method for determining the transfer function is presented. An analysis is carried out of the effect of nonlinearity in the motor control characteristics.

621-526

8429 POWDER CLUTCH ELECTRIC DRIVE AND ITS APPLICATION IN AUTOMATIC SYSTEMS.
G.F.Konovalov and Ya.I.Flid.
Avtomat. i Telemekh., Vol. 20, No. 5, 657-62 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 5, 629-33 (May, 1959: publ. Feb., 1960).

Results of investigations on powder clutches with solid filling are given. Expressions for static characteristics and transfer functions of clutches and clutch units are derived. A block schematic and a characteristic of a servo-system with powder clutch drives is cited.

621-526 : 621.317.39

A HIGH-RESOLUTION MEASURING SYSTEM USING COARSE OPTICAL GRATINGS. See Abstr. 7462

TELECONTROL . TELEMETERING

621.398

8430 ON INCREASING TELEMETERING EFFECTIVENESS. N.V.Pozin.
Avtomat. i Telemekh., Vol. 20, No. 10, 1403-8 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 10, 1369-73 (Oct., 1959: publ. June, 1960).

Ways are considered for increasing the effectiveness of information transmission by telemetry on the basis of taking into account such spectral characteristics of the measured parameter as the dependency on frequency of oscillation of the amplitude of the oscillations and measurement errors. A method of transmission with automatic changeover of the coding system is given. Estimates are made of the increase in speed of transmission and of the possible decrease in bandwidth.

621.398

8431 PULSE LENGTH TELEMETERING. A.O.Davies.
A.T.E.J., Vol. 16, No. 1-3, 86-95 (Jan.-July, 1960).

The elements of a single indication system and its operating principles are first considered followed by a description of the transmitting and receiving equipments and their performance. Similar treatment for multiple indication systems follows and reference is made to initiating equipment and applications other than the normal one of indication of varying quantities.

621.398

8432 DETERMINATION OF DESIGN PARAMETERS FOR A MEDIUM ACCURACY P.A.M.—F.M. TELEMETRY SYSTEM. M.B.Rudin.
I.R.E. WESCON Convention Record, Vol. 4, Pt 5, 102-14 (1960).

A procedure for establishing design parameters for a p.a.m.—f.m. radio telemeter is demonstrated and found to be compatible with experimental results. In addition, the advantage in spectral utilization of employing 100% duty cycle pulse transmission along with premodulation filtering of the video pulse train is discussed, and a method for pulse synchronization with 100% duty cycle transmission is described. A table of recommended parameters is presented for 2% r.m.s. transmission error at minimum transmitted power.

621.398

8433 SYNCHRONOUS RECEPTION IN A P.C.M./P.S. TELEMETRY SYSTEM. H.Raillard and H.N.Putschi.
Proc. Nat. Electronics Conf., Vol. 15, 163-72 (1959).

When p.c.m. is used in a practical system and the pulses are recovered with a matched filter, the noise threshold of an a.m. detector limits the system performance. Therefore, synchronous detection incorporating a threshold-free product detector is used. A carrier-locked local oscillator capable of tracking the Doppler shifts inherent in missile systems is used. The unit described properly reproduces digital signals with a non-random distribution of polarity. The problems of dynamic range and linearity required for threshold-free detection in the presence of noise as well as acquisition and tracking capability are dealt with in detail

621.398 : 621.391

8434 DIGILOCK COMMUNICATION SYSTEM. R.W.Sanders.
I.R.E. WESCON Convention Record, Vol. 4, Pt 5, 125-31 (1960).

A system for telemetry communication which attempts to approach more closely to Shannon's ideal channel capacity for given signal and noise powers. 5-bit binary numbers are coded into 16-bit Reed-Muller codes, which have the orthogonal property of zero correlation between any code and that removed from it by one bit. The receiver consists of a 16-tap delay line connected to a summing matrix having 32 output lines one corresponding to each of the 32 input levels represented by 5 bits. When the delay line is fully loaded a comparison is initiated and only one of the outputs has a large signal, the others being zero in a noise-free case. The carrier system is phase-modulated with a phase-lock loop in the receiver and word synchronization is achieved by modification of the Reed-Muller code. The digital encoding circuits are particularly simple and the overall transmission efficiency is better than that of the best coherent pulse-code-modulation system. G.H.Stearman

621.396

8435 A LIGHT TELEMETRY MOLECULAR SYSTEM. G.Struil.
Proc. Nat. Electronics Conf., Vol. 15, 640-4 (1959).

In a single block of appropriately doped semiconductor material, it is possible to obtain a complete light telemetry system. The system involves only the block, a power supply, and a load. The system functions in the following manner. In darkness a saw-tooth oscillation is generated. When visible light is incident upon the active element, the frequency of oscillation varies inversely with light level. This is achieved with virtually no amplitude modulation. All other semiconductor photo-devices interpret light with a change in d.c. level. To telemeter such data, the light must be chopped — a process involving additional circuit elements. In the unique molecular system described, the information is directly in a form suitable for transmission.

621.398 : 621.316.718

8436 A NEW PRINCIPLE FOR CONTACTLESS SIGNAL TRANSMISSION. W.Engel, F.Kuhrt and H.J.Lippmann.
Elektrotech. Z. (E.T.Z.) A, Vol. 81, No. 9, 323-7 (April 25, 1960). In German.

Contactless transmission of signals can be achieved in a number of ways but the use of magnetic fields has the advantage that a simple permanent magnet may be used as signal generator. The pick-up head incorporates a Hall-effect generator, the output from which is amplified by a bistable transistor amplifier. Systems using flat magnets and dipole magnets are described and static output characteristics are quoted. In both cases the output increases as the distance between magnet and pick-up is lessened. This type of system finds application in lift and conveyor controls. A.S.Hay

621.398

8437 CONTACTLESS TELEMETRY EQUIPMENT. Van Chuan'-Shan [Wang Ch'uan-Shan] and Lin Vèn'-Chzhen' [Ling Wên-Chên].
Scientia Sinica, Vol. 8, No. 12, 1570-80 (Dec., 1959). In Russian.

The system described was developed especially for use in coal mines and is derived from the ordinary 50 c/s mains. The step between pulses and the synchronizing pulse is 10 ms. The system was used to transmit information from up to 50 signalling points. At each end of the circuit there is a distributor which is synchronized to the mains frequency. Pulses are transmitted on a carrier frequency of 4 kc/s. The distributor circuits use ferrite cores, this material being more readily available in China than Permalloy. The oscillator and carrier-frequency amplifiers are transistorized. The display panel uses neon lamps. S.C.Dunn

621.398

8438 REED RELAYS SIMPLIFY MONITORING. F.W.Kear.
Electronics, Vol. 33, No. 30, 63 (July 22, 1960).

A single relay coil is arranged to energize discriminately a number of tuned-reed contacts with response frequencies of the reeds separated by bandwidths of at least 30 c/s including any harmonics. This provides means of long-distance data transmission by radio or by a single wire connection without the intervention of digital or analogue complication. In the system described a relay coil of 7500 ohms is energized at ± 20 V by a simple RC oscillator which is keyed by contact closure. R.W.J.Cockram

621.398

8439 INTERDEPENDENCE OF THE PARAMETERS OF RADIOACTIVE (GEIGER COUNTER) RELAYS.
A.G.Vasil'ev and K S.Klempner.
Avtomat. i Telemekh., Vol. 20, No. 3, 313-17 (1959). In Russian.

Analyses mathematically a telemetering system consisting of a Geiger counter and high-impedance relay connected across a source of voltage. The telemetering signals are gamma rays. The results of the calculation have been checked by experiment.
A.E.I. Research Laboratory

621.398

8440 WIND VELOCITY TELEMETERING SYSTEM. R.Beaulieu and G.Neal.
Electronics, Vol. 33, No. 29, 68-70 (July 15, 1960).

An anemometer vane is linked to a commutator and switches on one of eight a.f. oscillators tuned to different frequencies for N, N.E, etc. Wind speed is measured by means of a cam-operated switch, driven by the cups, which gives a pulse for each mile of wind. Provision is made for wind speed to override direction should the speed pulse occur during one of the direction-sampling periods. At the receiver, decoding is by a.f. filters which pass signals to separate thyratrons to operate pens. All circuits are transistorized. W.G.Stripp

621.398

8441 F.R.E.S.C.O. — AN AIRBORNE FREQUENCY METER WITH DIGITAL OUTPUT. J.Ackroyd.
Brit. Commun. and Electronics, Vol. 7, No. 7, 502-7 (July, 1960).

A pressure transducer in a guided missile has as output a frequency-modulated signal in the range 3.5 to 10.5 kc/s. Rather than attempt to transmit the signal direct to the ground for measurement, it is more economical to measure the frequency in the missile and transmit the result in coded digital form. In this way 10 transducers may be dealt with by a single 24-channel telemetry system. The equipment is described in detail and gives a frequency resolution and accuracy of 1 in 100 parts. G.H.Stearman

621.398

8442 ALTITUDE TELEMETRY IN CONJUNCTION WITH AIR TRAFFIC CONTROL. D.G.Terrington.
Brit. Commun. and Electronics, Vol. 7, No. 9, 660-5 (Sept., 1960).

Height finding methods at present used for air traffic control are briefly discussed. An experimental system of altitude telemetering in which aircraft transmit details of height to traffic control is described in detail. R.C.Glass

621.398

8443 PROJECTILE TELEMETRY WITH MICROWAVES. W.M.Kendrick and L.A.Peters.
Electronics, Vol. 33, No. 38, 68-71 (Sept. 16, 1960).

Measurements have been made during the firings of 2.75 in. gun-boosted rockets by the use of 24 Gc/s circuits. A source of about 10 milliwatts is required with fluctuations in amplitude and frequency of less than 1% per millisecond. The nose of the projectile carries a ferrite device whose reflection coefficient can be used to modulate the reflected microwave signal. A 15 in. parabola produces a beam which is deflected through 90° by an aluminium sheet reflector 15 ft. in front of the gun. The beam converges to a focus at the mouth of the gun. The signal level inside the gun barrel is a function of position and may fluctuate as much as ±10 dB. The projectile carries a transistor oscillator and driver circuit which converts the output of a variable capacitance accelerometer to an f.m. sub-carrier signal suitable for modulating the microwave beam. The telemetering sub-carrier is at about 300 kc/s. At reception the telemetering signal is shifted down to 70 kc/s and recorded directly on tape. The ferrite device uses R-1 material in a Faraday rotator. The accelerometer produces a frequency shift of 2 kc/s per 1000 p.s.i., a range of 10 000 p.s.i. and an initial capacitance of 20 pF. S.C Dunn

621.398

8444 MISSILE COMMUNICATION DURING RE-ENTRY BLACKOUT.
K.M.Baldwin, O.E.Bassett, E.I.Hawthorne and E.Langberg.
Electronics, Vol. 33, No. 22, 105-9 (May 27, 1960).

The conditions of intense ionization surrounding a re-entry head are described. Two possible telemetry systems suitable for re-entry use are discussed. The first operates in the v.h.f. band using a p.a.m.–f.m.–f.m. system. Because there may be serious attenuation in the re-entry plasma, the transmitted data are also recorded on magnetic tape and a data cassette ejected for recovery after re-entry over the sea. The plasma attenuation is small at millimetre wavelengths. The second system uses a frequency in the Ka band with p.p.m. The transmitter is small and light but a disadvantage is the highly directional receiving aerial which requires accurate tracking. W.T.Blackband

621.398

8445 INSTRUMENTATION FOR A THERMAL RADIATION BUDGET SATELLITE.
R.J.Parent, H.H.Miller, V.E.Suomi and W.B.Swift.
Proc. Nat. Electronics Conf., Vol. 15, 824-39 (1959).

Describes two types of electronic equipment package which have been built for earth satellite experiments. Both incorporate instrumentation and telemetry for an important meteorological experiment which is designed to measure total radiant heat flow to and from the earth. To perform this experiment, several bolometer temperatures are measured and telemetered to earth. From these measurements meteorologists hope to gain a better understanding of the forces which cause the earth's atmosphere to circulate the produce our weather. Temperature measurements are carried out by means of thermistors whose resistance governs the pulse repetition rate of a blocking oscillator. The pulse repetition rate is measured by counting pulses in a binary scaler for a short interval. This count is then either recorded and stored on magnetic tape until released by interrogation for transmission to ground receiving stations or else used to key a transmitter and telemeter the information as it is collected. Switches driven from a tuning-fork-controlled clock are used to select different bolometers in sequence and to control timing. In either case, signals are received on earth and appropriately recorded on magnetic tape. This, after some preliminary automatic processing, is used as input to a large electronic computer which has been equipped to accept the signals directly. The instrumentation, which has been developed, is extremely rugged, light in weight, and capable of operating under extreme conditions of power supply voltage and temperature. Problems with noise which are encountered in satellite telemetering systems are considered with reference to both systems.

621.398

8446 TEMPERATURE TELEMETRY AIDS FROZEN FOOD STUDY. R.H.Elsken.
Electronics, Vol. 33, No. 33, 129-31 (Aug. 12, 1960).

Up to 10 low-powered transistor oscillators, tuned at 10 kc/s intervals in the range 100–200 kc/s, are distributed throughout 50-ton batches of frozen food to give temperature distribution information. The oscillators work in a squegging mode with squegging frequencies in the range 250–500 c/s, set by a thermistor inserted into an actual fruit package. The outputs from the oscillators are scanned by a selective receiver and the squegging frequency measured to give the temperature. Oscillators are individually adjusted before use, and the size of an oscillator, its battery (life 350 h), and a transistor d.c.-to-d.c. convertor (used to improve efficiency) equals that of a standard 10 oz fruit package. W.D.Gilmour

621.398

8447 FIRE-ALARM STARTING BY VOICE-FREQUENCY SIGNALLING. D.Jørgensen.
Teleteknik (Danish Edition), Vol. 11, No. 1, 31-2 (June, 1960). In Danish.

Describes a 2-voice-frequency signalling circuit which has been in operation in South Jutland. It enables the starting of fire-alarms to be telecontrolled via a rural automatic exchange from an emergency-call receiving station connected to a distant parent exchange. G.N.J.Beck

621.398

8448 DEVELOPMENT AND APPLICATION OF TIME-DIVISION MULTIPLEXING TELEMETERING EQUIPMENT FOR DATA TRANSMISSION ON AN ELECTRIC POWER SYSTEM.
G.P.Almon, Jr and J.Donelson, Jr.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 155-9 (1960) = Commun. and Electronics, No. 48 (May, 1960).

Within the operation area of the Tennessee Valley Authority there is need to interchange information where high speed response is not required. The speed of transmission is so reduced that information can be sequentially scanned and transmitted over one narrow-band telemetry channel. The basic instrument chosen is a Leeds and Northrup 2.4 second Speedomax impulse telemeter. The impulse lengths are made proportional to the [illegible] readings and initially six quantities were transmitted. The transmission consists of two telephone-type rotary switches, one operating as a scanner and the other as a timer. The receiver uses similar instruments and operates as a comparator. Each quantity is scanned at an interval of about 45 sec. The instruments used are also capable of transmitting up to 19 quantities over the same circuit. In addition to the effect of reliable transmission of readings of generator and sub-station power outputs the system can be applied to the telemetering of incremental-cost data where the distances from the despatch centre to the various plants are relatively large.
S.C.Dunn

621.398

8449 TELEMETERING AND REMOTE-CONTROL EQUIPMENT FOR THE INN RIVER PRUTZ-IMST POWER STATION OF THE TYROL POWER COMPANY (TIWAG).
W.Kravs and W.Köchl.
W.S.W.-tech. Bur., Vol. 11, No. 1, 19-23 (April, 1959).

Deals with equipment required for transmission of two-level variables and for remote control and return indications of three sections — each with two sluice boards — of a sluice dam with the TIWAG's Prutz-Imst power plant. All the control signals, return indications, level values and various alarms are transmitted over two wires of a P.T.T. communications cable, already utilized by a telephone channel, by superimposing two audio tones over the v.f. band and thereby providing two coded pulse channels.

621.398

8450 A WATER LEVEL INDICATOR.
M.Tiuri.
Kraft o. Ljus, Vol. 33, No. 7-8, 158-61 (July-Aug., 1960). In Swedish.

The Jumisko power station in Finland is fed from many lakes whose water level must be continuously monitored. Distances involved are 35-40 km, max. water level variation is 5 m and the level must be measured to within 1 cm. For this purpose a radio telemeter was devised. The position of a float on the water surface determines the value of a variable capacitor which in turn determines the audio-frequency of an amplitude-modulated v.h.f. (33.6 Mc/s) transmitter. The receiver at the power station is a double-superheterodyne and signals are displayed on a c.r.t. The equipment has operated with acceptable reliability for a year. G.N.J.Beck

621.398 : 621.376.334

AN IMPROVED F.M. DISCRIMINATOR-DETECTOR FOR AIRBORNE TELEMETRY RECEIVERS. See Abstr. 7905

621.398 : 621.395.44

THE EFFECT OF DELAY DISTORTION ON DATA TRANSMISSION. See Abstr. 8148

621.398

8451 THE RELIABILITY OF OPERATION OF REMOTE CONTROL DEVICES. N.S.Shabalin.
Elektrichestvo, 1960, No. 6, 91-3 (June). In Russian.

The quantitative definition of reliability is first explained and it is shown how in a given installation reliability may improve with time in some circumstances but in others may reach a certain pitch and then begin to degenerate. From an analysis of the contributions made by the separate parts of the system to the overall performance it is concluded that ultimately the overall reliability is best improved by reducing the number of separate elements required. S.C.Dunn

621.398

8452 ANALYSIS OF THE OPERATION OF PULSE MAGNETIC ELEMENTS IN CONTACTLESS TELECONTROL DEVICES. I.V.Prangishvili.
Avtomat. i Telemekh., Vol. 20, No. 4, 473-85 (1960). In Russian.

The operation of pulse magnetic elements with rectangular hysteresis loop is analysed when the elements are fed with sinusoidal voltage of industrial frequency. Some relations are deduced. Design of a single element and pulse relay is described.

621.398 : 621.372.54

8453 THE EFFECT OF NOISE ON SYNCHRONOUS FILTER-GENERATOR OPERATION. A.M.Luchuk.
Avtomat. i Telemekh., Vol. 20, No. 7, 963-9 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 7, 938-44 (July, 1959; publ. March, 1960).

An analysis is made of the operation of a synchronous filter generator with sinusoidal noise at its input, and the results are given of an experimental investigation of the noise stability of telecontrol devices with synchronous filter generators. A qualitative and quantitative estimate of the effect of noise on synchronous filter operation is given, permitting correct calculation of its parameters.

621.398 : 621.396.621

RADIO COMMAND SET FOR HIGH-ALTITUDE BALLOONS. See Abstr. 8197

COMPUTERS . APPLICATIONS

(Refer also to Digital circuits . Switching circuits)

681.142

8454 AUTOMATION OF COMPUTER PANEL WIRING.
G.W.Altman, L.A.DeCampo and C.R.Warburton.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 118-25 (1960) = Commun. and Electronics, No. 48 (May, 1960).

A computer programme is described which is used in the design of new data processing machines. This prepares wiring lists and a bill of material for use in production and assembly, for a standardized panel into which are plugged printed-circuit cards. The programme routes the wires, subject to certain design conditions, to connect specified pins with the minimum overall wire length and with the least electrical interference between wires. H.Morrison

681.142 : 621-52 : 621.318.3

A LIST OF THE [RUSSIAN] LITERATURE OF 1958 ON MAGNETIC ELEMENTS FOR AUTOMATION, REMOTE CONTROL AND COMPUTING TECHNOLOGY. See Abstr. 7542

681.142

8455 A DIGITAL COMPUTER STORE WITH VERY SHORT READ TIME. T.Kilburn and R.L.Grimsdale.
Proc. Instn Elect. Engrs, Paper 3176 M, publ. Jan., 1960. (Vol. 107B, 567-72, 605-7).

Republication with discussion of the paper already abstracted as Abstr. 1081 of 1960.

681.142 : 621.374.32

PARELLEL ARITHMETIC UNIT USING A SATURATED-TRANSISTOR FAST-CARRY CIRCUIT. See Abstr. 7787

681.142

8456 THE 1301 DATA PROCESSING SYSTEMS.
R.Bird and J.H.Wensley.
G.E.C. J., Vol. 27, No. 2, 77-85 (Spring, 1960).

A description of a computer system having card input, line printing or card punch output, up to 2000 (12 decimal digit) word core storage backed up by up to eight 12000-word magnetic drums, a 1 Mc/s p.r.f. arithmetic unit working in binary coded decimal or sterling, and up to 8 magnetic tape transports. The computing circuits use Eccles–Jordan type binary circuits and germanium diode and transistor gating circuits, and an outline of the logical structure is given. The line printer can operate up to 570 lines per minute. The construction uses wrapped joints extensively and a comprehensive display enables the service engineer to locate faults quickly. G.A.Montgomerie

681.142

8457 THE DESIGN OF A SPECIAL PURPOSE DIGITAL COMPUTER. D.Halton.
A.T.E.J., Vol. 16, No. 1-3, 32-64 (Jan.-July, 1960).

The equipment considered is a real-time computer, designed

to operate within timing limits imposed by an external system. The computer is a parallel, binary machine, using a single-adress ordering system. The principles of a digital computer are described, together with the various units in this particular machine. The method of programming is also indicated. The control unit is notable for its flexibility.

681.142

8458 THE COMBI-SYSTEM — A PROPOSAL FOR NEW CONCEPTS IN DIGITAL DATA PROCESSING. H.Schwab.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 193-7 (1960) = Commun. and Electronics, No. 40 (July, 1960).

Many applications of digital data processing require large volumes of data to be acquired, handled, evaluated and displayed with little or no actual computation occurring. For these applications a general purpose computer with peripheral equipment does not represent an optimum solution. Proposals are made for the use of a set of "submodules" specifically chosen for their utility in such applications and symbols, both graphic and algebraic, are suggested to represent respectively the submodules and the operations they perform. The six operations suggested as basic are selection, comparison, switching, buffer storage, control and translation. Examples are given of their combination in block diagrams and the possibility of developing an appropriate algebra pointed out. Some prototype models of the submodules are briefly described.

G.H.Stearman

681.142

8459 A DYNAMIC LOGIC TECHNIQUE FOR SIXTEEN MEGACYCLE CLOCK RATE.
T.P.Bothwell, J.L.DeClue, H.H.Hill and J.R.Longland.
I.R.E. WESCON Convention Record, Vol. 4, Pt 4, 116-26 (1960).

Describes a family of 16 Mc/s dynamic logic packages which employ non-return-to-zero information signals. Functional equivalence to pulse-dynamic logic is demonstrated and principles of non-return-to-zero dynamic signal representation operation are reviewed. The basic circuit package, a logic element, is described functionally. Circuit operation and performance is reviewed. Compatible passive and active delay lines are also described. Supporting master and local clock packages are described and clock transmission and timing problems discussed. Problems of signal wiring and transmission are considered, and a sample logical structure presented. Packaging and cooling problems are detailed and selected solutions are presented.

681.142

8460 HIGH FREQUENCY MAGNETIC FILM PARAMETRONS FOR COMPUTER LOGIC.
A.V.Pohm, A.A.Read, R.M.Stewart, Jr and R.F.Schauer.
Proc. Nat. Electronics Conf., Vol. 15, 202-14 (1959).

Magnetic-film parametrons (phase-locked subharmonic oscillators) were constructed using time-variable inductors made from 6×10^{-6} cm thick 80–20 Permalloy films. The pump field was applied parallel to the rest direction of magnetization while the signal field was applied perpendicular to the rest direction. Measurements of the transient response, frequency range, power consumption, and saturation characteristics were made using about a 14.5 Mc/s pump frequency. Operation with a 25 Mc/s pump was observed but measurements were made at the lower frequencies because of instrumentation difficulties. Two- and three-state operations were observed for a single bias condition. Four- and five-state operations were observed when both bias conditions were allowed. The dynamic behaviour of magnetic films was analysed in terms of a modified Landau–Lifshitz equation and the parametron threshold and transient and saturation characteristics were analysed in terms of a modified Hill's equation. Calculations show that operation above 100 Mc/s is possible using Permalloy films.

681.142

8461 MILLIMICROSECOND DIODE CAPACITOR MEMORY.
M.M.Kaufman.
Proc. Nat. Electronics Conf., Vol. 15, 215-25 (1959).

In 1953, the National Bureau of Standards built a diode–capacitor memory of 10^4 bits with a 10 μs cycle time. The memory operated on the principle that a diode in its region of high conduction could deliver to and store on a capacitor, a charge in a relatively short time compared to the time it would take this charge to drain off in the diode's low conduction region. The N.B.S. memory used diodes of the junction type which have a basic speed limitation because of minority carrier storage and diffusion time. It is shown that, using faster diodes, the cycle time for a diode–capacitor memory can be reduced to 10 ns. The diode–capacitor storage technique was studied and a prototype memory built to evaluate the difficulties in reducing the cycle time to approximately 10 ns. A theoretical analysis considering the worst conditions for operating such a memory allows tabulation of its ultimate capabilities.

681.142

8462 25-MC CLOCK-RATE COMPUTER CIRCUITS FOR OPERATION FROM -20° C TO +100° C. C.R.Cook, Jr.
I.R.E. WESCON Convention Record, Vol. 4, Pt 4, 105-15 (1960).

Pulse generators, full adders, and shift registers have been designed and built for operation at clock-rates up to 25 Mc/s and over a temperature range from -20° to +100° C. Current-mode, inhibit and complementary circuit techniques are used to obtain maximum speed with two types of presently available silicon transistor. The complete system is reasonably simple. Conventional high-frequency circuit packaging techniques are used. The full adder circuit results in sums and carry serial information propagating speeds at 100° C that previously were only possible using parallel organization. It will give a sum or carry with less than 20 ns delay (average delay is less than 10 ns) when used in a serial application. With parallel organization, the carry propagation time is less than 15 ns per stage, at 100° C. The full adder consists of ten transistors, one diode, 11 resistors and 3 inductors. The shift register and pulse generator used as a clock-pulse generator are designed to realize the full adder speed. The shift register uses 2 transistors per stage with diodes and RLC steering. The pulse generator consists of a complementary delay-line oscillator and amplifier which has only 4% change in frequency over the temperature range.

681.142

8463 THE EFFECT OF LINK ELIMINATION IN DATA TRANSMISSION SYSTEMS. A.Machi and J.Hoffman.
I.R.E. WESCON Convention Record, Vol. 4, Pt 7, 3-18 (1960).

Data transmission systems originally handle traffic loads with all the transmission links functioning under normal conditions. The effects on the system when any one transmission link is eliminated are discussed. The transmission links carry data in the form of "bits" between the nodes in the network.

681.142

8464 MESSAGE PROTECTION IN AN AUTOMATIC SWITCHING CENTER. A.S.Rettig and H.P.Guerber.
Proc. Nat. Electronics Conf., Vol. 15, 606-15 (1959).

Auto Data (see also following abstract) is an electronic system for the collection and dissemination of messages in digital form. It is designed to provide the link between communication facilities and digital data handling equipment. Various levels of message protection are provided to meet the requirements for monitoring and auditing inter- and intra-centre traffic. The former requirement is accomplished by a set of procedural rules for message acknowledgement, and the latter requirement is provided by various accounting functions. These accounting functions include magnetic tapes for the accumulation of messages and various message control information, and a journal drum functioning as a "check-off" list for the messages in the centre awaiting transmission. The procedure thereby insures that each message will always be quickly indentified, traced, and return from the switching centre whenever necessary and avoids the need to query the originating station. The procedural rules for message acknowledgment assure that incoming messages are adequately identified for future reference and recorded in its entirety before acknowledgment is given to the sender.

681.142

8465 AUTODATA - R.C.A'S. AUTOMATIC MESSAGE SWITCHING SYSTEM.
J.L.Owings, T.L.Genetta and J.F.Page.
Proc. Nat. Electronics Conf., Vol. 15, 616-23 (1959).

Describes the system design of an automatic store and forward type message switching centre and reviews the implementation of the system requirements with modern computer techiques. The system is capable of receiving messages which are originated on paper tape, punched cards, magnetic tape and other digital media; controlling their distribution throughout a wordwide communication network consisting of voice-frequency lines, microwave and radio links; and finally delivering the messages to their destination in suitable form

for either manual use or automatic processing on computers. The first part is concerned with identifying the problem, describing the techniques and reviewing the important advantages of this system. The essential functional characteristics of a message-switching system are established. The second part is concerned with a method for the implementation of a system designed to meet the requirements for an automatic message switching centre. Emphasis will be placed on the capability and flexibility of the system.

681.142 : 621.395.354

SUBSCRIBER'S METER RECORDING IN AN ELECTRONIC TELEPHONE EXCHANGE. See Abstr. 8134

681.142

8466 **GENERATION OF RANDOM NUMBERS ON AUTOMATIC CALCULATING MACHINES.** S.Von Hoerner.
Z. angew. Math. Phys., Vol. 8, No. 1, 26-52 (1957). In German.

Numerical and physical methods of generating random numbers are discussed. Some well-known numerical methods are described briefly and some basic notions (mixing of digits, fixed and stable cycles and degeneration) and different ways of testing are introduced. A new method which avoids stable cycles and degeneration is described. In this method

$$x_{i+1} = x_i^2 \text{ for } x_i^2 \geq b$$

$$x_{i+1} = x_i^2 + a \text{ for } x_i^2 < b.$$

The physical method described depends on counting gamma-quanta over a time defined by a gating pulse and an experimental equipment using this principle is described as built for the G2 computer of the Max-Planck-Institut at Göttingen. G.A.Montgomerie

681.142 : 621.314.2

8467 **ELECTRONIC TRANSFORMER DESIGN BY DIGITAL COMPUTERS.** L.F.Deise, W.Etchison and R.Lee.
Trans Amer. Inst. Elect. Engrs I, Vol. 79, 314-23 (1960) = Commun. and Electronics, No. 49 (July, 1960).

Discuss the advantages and procedures in the use of digital computers in the design of electronic transformers. The main features, from an engineering viewpoint, of several computer programmes already in use are outlined, and specimen results are tabulated. The logic of other programmes is presented in greater detail in appendices. H.Morrison

681.142 : 621.311.22

8468 **COMPUTER CONTROL OF HUNTINGTON BEACH STATION.** A.L.Guidero.
I.S.A. J., Vol. 7, No. 9, 84-9 (Sept., 1960).

Two new 210 MW generating sets are to be automatically controlled by a computer which is to supervise the functions of the conventional centralized plant control under conditions of: cold startup; hot restart; normal operation; normal shutdown; and emergency shutdown. To do this it has to scan in not more than one second 300 analogue inputs for control, in not more than one minute 100 analogue inputs for on-demand and alarm printout, some to be logged periodically, as well as another 500 analogue and digital inputs. In the final design, the total inputs were increased to 1050, outputs to 400 and (drum) memory to 32 000 words, and one General Electric Model 312 digital computer is to be installed for each set. The loops to be controlled in various parts of the generating sets are discussed in a general way. G.A.Montgomerie

681.142

8469 **A SOLID-STATE DIGITAL COMPUTING SYSTEM FOR ELECTRIC LOAD MONITORING.**
R.J.Thomas, J.O.Gustafson and G.E.Foster.
Trans Amer. Inst. Elect. Engrs III, Vol. 79, 235-41 (1960) = Pwr Apparatus Syst., No. 48 (June, 1960).

The Paducah plant of the U.S. Atomic Energy Commision is supplied by so many lines that, with conventional metering equipment, it is not possible to determine the demand until approximately 20 minutes after the demand period. In addition, true demand is not recorded exactly. A power load anticipator (p.l.a) has been developed to overcome these difficulties so that an almost 100% load factor can be achieved. The demand is anticipated by extrapolation using the power consumed up to and the rate of consumption for the 5 minutes prior to a prediction. Core transistor logic elements are used throughout except for the input and output circuits. A trial run with the p.l.a. showed that the equipment is very reliable and it is predicted that savings achieved by its use could pay for the equipment in a very short time. A.S.Hay

681.142

8470 **THE APPLICATION OF COMPUTERS IN THE CHEMICAL INDUSTRY. I.** T.Ankel.
Regelungstechnik, Vol. 8, No. 7, 227-33 (July, 1960). In German.

681.142

8471 **A DIGITAL COMPUTER PROGRAM FOR REDUCING LOGICAL STATEMENTS TO A MINIMAL FORM.**
K.J.Butler, Jr and J.N.Warfield.
Proc. Nat. Electronics Conf., Vol. 15, 456-66 (1959).

A digital computer programme is described that will reduce logical statements of nineteen or more variables to a minimal expression. If a unique minimal expression does not exist, the programme is designed to present the alternative expressions so that the final choice of simplicity is left to the designer. The reduction method is a modification to the method of Harris [I.R.E. Trans Electronic Comput., Vol. EC-6, 103 June,(1957)] which utilizes an n-dimensional cube for representing the logical statement. The computer programme makes use of the directional components present in the topological representation of the logical statement. Simple relationships involving the directional components are shown that help to reduce the computer memory requirements and also to eliminate repetition of previously performed operations. Though specifically intended for the computer, the method used in the programme is quite convenient without a computer. An illustrative example is included.

681.142

8472 **DIGITAL SIMULATION IN PERCEPTUAL RESEARCH.** E.E.David, Jr.
Proc. Nat. Electronics Conf., Vol. 15, 322-8 (1959).

Evaluation of communications systems transmitting visual or auditory information is complicated since the final message destination is a human observer. It is the perceptual significance of transmission distortions which must form the basis for evaluation. Following this prescription, signal samples with specified distortions must be generated to serve as material for subjective evaluation. These samples can be obtained at the output of the system under test by supplying an appropriate input. In some instances, however, the system has never been built as an operating model, or is, perhaps, inaccessible. Here a digital computer can often be programmed to simulate the system and generate the desired samples. Several investigations using this technique have been carried out using ρ data translator to provide an input–output link to the computer. The significant properties of several band-saving codings have been so obtained. The programming and computing effort required is modest. A compiling routine to aid in programming similar problems has been devised. Potentially this technique can be extended to generate complex stimuli for psychological exploration of perceptual mechanisms.

681.142 : 621.372.54

8473 **APPLICATION OF AN ELECTRONIC DIGITAL COMPUTER IN NETWORK THEORY.** H.Hürtl.
Nachrichtentech Z. (N.T.Z.), Vol. 13, No. 7, 313-16 (July, 1960). In German.

The programming of a digital computer which enables a fast analysis of a filter network or a synthesis to a prescribed damping and frequency contour to be made is discussed. For a synthesis the type of circuit must first be chosen. The application is particularly useful in assessing the effect of component tolerances and for determination of optimum values. A general programme deals with an arbitrary network of n nodes for which a number of single-frequency solutions are obtained. Any network parameters can then be derived. Z.A.A.Krajewski

681.142

8474 **FUTURE TRENDS IN AIR TRAFFIC CONTROL AS INFLUENCED BY MODERN RADAR AND DATA-PROCESSING TECHNIQUES.** A.G.VanAlstyne.
I.R.E. WESCON Convention Record, Vol. 4, Pt 6, 104-8 (1960).

681.142

8475 **DATA PROCESSING REQUIREMENTS OF THE F.A.A. AIR TRAFFIC CONTROL DATA PROCESSING CENTRAL.** N.Pomerance.
I.R.E. WESCON Convention Record, Vol. 4, Pt 6, 95-101 (1960).

A general survey of the air traffic control functions to be carried out by automatic equipment in a system using the conventional printed flight progress strips which are presented to a human controller for decision and action. The composition of the equipment is detailed; it is capable of processing 440 flight plans

per hour. Interconnection with the SAGE early warning system is also possible. Reliability is achieved by duplication of a number of units and extensive parity checks. G.H.Stearman

681.142

8476 CENTRAL DATA PROCESSOR OF THE AIR TRAFFIC CONTROL SYSTEM. L.L.Wolman.

I.R.E. WESCON Convention Record, Vol. 4, Pt 6, 85-94 (1960).

Discusses various features of the Central Data Processor designed for the Federal Aviation Agency. The system contains a high-speed general-purpose computer, a file control system, a multiple magnetic drum file system, a highly multiplexed buffer system, and a switching system for rapid exchange of on-line and spare computers. Basic characteristics of the individual elements of the system, such as extensive error checking, are discussed, as well as special features, such as the file key search, which are particularly needed for air traffic control.

681.142

8477 A MULTI-ADDRESSABLE RANDOM ACCESS FILE SYSTEM. E.A.Coil.

I.R.E. WESCON Convention Record, Vol. 4. Pt 4, 42-7 (1960).

Describes a new file system capable of retrieving information on the basis of content alone. Data are first recorded in randomly distributed locations, the availability of which are automatically recognized by the file system itself. The term "multi-addressable" stems from the fact that several different criteria may be employed, either individually or in combination, to retrieve a desired piece of information from the file. No increase in access time over the conventional fixed-address operation is involved. Provision is also made for returning a record to its original location after processing.

681.142

8478 DIGITAL CONTROL TECHNIQUES FOR SPACE. L.F.Jones and P.Margolin.

I.R.E. WESCON Convention Record, Vol. 4, Pt 4, 6-23 (1960).

The considerations affecting the use of digital computer controllers in space vehicles (manned or unmanned) are explored. The projected augmentation of system control capability is contrasted with the penalties (of size, weight and power) incurred, to determine under what conditions a digital computer controller can be employed to advantage. The desirability of planning for the use of a digital controller is stressed. System control functions are analysed to determine the corresponding digital computer requirements. The role of a digital computer as a means for upgrading the probability of mission success and of overall equipment reliability in a space environment is discussed. Digital computer hardware techniques are surveyed in terms of size, weight and power both as regards electronic circuit techniques and packaging. A combination of a magnetic disk memory, transistor-diode circuitry, code disk input devices, permanent magnet stepping motor output devices, flexible multiple layer printed circuitry and molecular electronic blocks are deemed desirable and feasible.

681.142 : 621-52

8479 AUTOMATIC TEST EQUIPMENT CHECKS MISSILE SYSTEMS. D.B.Dobson and L.L.Wolff.

Electronics, Vol. 33, No. 29, 74-8 (July 15, 1960).

The Digital Evaluation Equipment (D.E.E.) checks electronic subassemblies of missile systems. The test programme is punched on paper tape which is transferred to a magnetic tape file. When a unit under test is connected to the equipment the adaptor by which it is connected supplies an identification causing the magnetic tape file to be searched for the correct programme. Inputs and outputs of the unit under test are connected to the system if necessary through a convertor which accepts various analogue information and converts it to digital form. An elaborate switching network is provided so that any one or more of 200 relay trees can be set up to control various functions in various ways and the test results are returned to the evaluation equipment and printed out. Various stimulus waveforms can be provided and correspondingly various properties of output waveforms can be analysed. Block diagrams are given for the system as a whole, for the switching system, for the sampling amplifier which measures waveform rise times and compares circuit performance with original specifications, an analyser which measures the linearity of test waveforms, and the device for pulse width measurement (of which a detailed circuit diagram is given).

G.A.Montgomerie

681.142 : 621.389

AUTOMATIC PROGRAMMING OF GROUND SUPPORT CHECK-OUT EQUIPMENT USING COMPUTER TECHNIQUES. See Abstr. 8043

681.142

8480 THE DEUCE COMPUTER AS AN AID TO RAILWAY TRACTION DESIGN AND OPERATION.

A.Gilmour and S.D.Van Dorp.

Engl. Elect. J., Vol. 16, No. 6, 5-27, 30-31 (June, 1960).

To aid locomotive design a programme has been developed for Deuce which simulates the performance of an engine of specified characteristics pulling a train over a given route. The basic equations solved and the main logic of the programme are given. Supplementary programmes to prepare the input data and to utilize and present the output data are outlined. Results from such performance calculations on Deuce have also been used in modifying timetables on the introduction of new types of engine. A study currently under way to programme the compilation of timetables is described. A problem concerning the movement of loaded and empty goods wagons has been successfully tackled using linear programming techniques. H.Morrison

681.142 : 621-52

DESIGN OF CONTINUOUS LINEAR CONTROL SYSTEMS FOR MINIMUM PROBABILISTIC ERROR. See Abstr. 8406

681.142 : 621.391

8481 THE DEVELOPMENT FOR A CHARACTER-READING APPARATUS FOR TYPEWRITTEN NUMBERS.

W.Dietrich.

Nachrichtentech. Z. (N.T.Z.), Vol. 13, No. 7, 317-20 (July, 1960). In German.

The instrument embodies a spot-light scanning and optical system which scans each figure horizontally and vertically as the paper moves from right to left. The reflected light is picked up by a photomultiplier cell. The resulting current pulses are first shaped and then passed via a storage and registering system to recognition circuits which compare the received group of pulses with that corresponding to a standard figure. If so recognized, a group of lamps indicating the particular figure lights up. The system is primarily designed for use in financial accounting and the instrument incorporates cross-checking techniques to eliminate false recognition. H.G.M.Spratt

681.142

8482 AN ADAPTIVE CHARACTER READER. P.Baran and G.Estrin.

I.R.E. WESCON Convention Record, Vol. 4, Pt 4, 29-41 (1960).

A pattern recognition system utilizing information derived from a machine learning operation is described. Samples of a set of characters are first identified by a human operator. From such inputs, a probability matrix is computed, and used to derive a set of weighted filters or stencils which distinguishes each character relative to the set of possible characters. When unknown characters are read, the proposed pattern recognition machine produces estimates of the confidence of the identification. A digital simulation of the proposed technique was performed on an I.B.M. 709 computer. A possible implementation having a raw character reading rate of up to 500 characters per second appears feasible. When low confidence estimates are encountered for certain unknown characters it is possible to call upon more complex processes to aid recognition. Thus, a recognition system can be built having greater accuracy than the basic reading machine. This technique is particularly useful in dealing with distorted characters encountered in language text.

681.142

8483 A REVIEW OF THE PERCEPTRON PROGRAM. A.E.Murray.

Proc. Nat. Electronics Conf., Vol. 15, 346-56 (1959).

"Perceptron" is the class name for a family of pattern recognition machines. They can learn to discriminate several categories. After exposure to a few samples in a category, such a machine tends to recognize spontaneously or classify correctly a new sample. This paper reviews principal conclusions from past work and indicates some plans for the future.

681.142

8484 DATA COMPRESSION. H.Schwab.

I.R.E. WESCON Convention Record, Vol. 4, Pt 5, 207-10 (1960).

Data compression is a data processing operation for reduction of data volume without reduction of specific information. Such compression is desired for bandwidth saving in communication and for simplification of successive data processing operations. Data compression has to be investigated in close connection to data encoding methods for best overall system efficiency. Typical examples for simple data compression are: sampling rate reduction, accuracy reduction, increment monitoring, event monitoring, source analysis. Data compression is of importance in space and industrial communication, reconnaissance, and high-speed high-volume data handling. The basic concepts of data compression are discussed. Compression methods are explained in connection with specific applications and in respect to data encoding problems. Some equipment for data compression is discussed.

681.142

8485 ENCODING TECHNIQUES FOR VISUAL DISPLAYS IN COMPUTER-AIDED SYSTEMS. K.M.Newman.

I.R.E. WESCON Convention Record, Vol. 4, Pt 4, 66-79 (1960).

Three experimental approaches to the problem of symbolic encoding for visual displays associated with large computer-aided data handling and data processing systems are presented and discussed. The first study was concerned with the readability of six different symbologies, consisting of geometric, alpha-numeric, and a combination of both codes. No statistically significant difference between the six symbologies was found, although taken as a group, the geometric symbols did show a significantly faster response time. The second approach, presently still under investigation, has as its objective a comparison of the effectiveness — in terms of speed and accuracy — of symbol-only encoding with a non-redundant symbol-plus-other-dimensions code; specifically 2 brightness levels, 3 flashing rates and 3 colours. The theory, criteria, and instrumentation are discussed. A third technique for visually presenting encoded information, scheduled for investigation in the immediate future, concerns itself with the conveying of tactical messages by using a spatial code within a given frame of reference as compared to presenting these tactical messages in an abbreviated alphabetic code, and it is presented and discussed with reference to method, instrumentation, design, and procedure.

681.142

8486 A HIGH-SPEED COLOR DISPLAY UNIT. W.H.Huntley, Jr.

I.R.E. WESCON Convention Record, Vol. 4, Pt 4, 150-61 (1960).

A high-speed colour display unit is displayed, which uses a 10 in. Chromapix (Lawrence) tube with electrostatic deflection and high-frequency colour switching, and provides full colour mixing at higher rates than have previously been possible on a single screen display. The capabilities of the unit, including full colour display of transients as short as 5 μs, and excellent colour registration over the entire display screen, are described. Some of the more important design considerations are discussed, and some conclusions regarding over-all performance are given. This unit is currently in operation in connection with investigations of c.r.t. display techniques.

681.142 : 621.374.32

ELECTRICAL READOUT. See Abstr. 7793

681.142 : 621.374.32

USING FERRITE CORES TO RECOGNIZE WORDS. See Abstr. 7783

681.142

8487 A MAGNETIC-TAPE-TO-PAPER-TAPE CONVERTER. M.Ringer and L.Mintzer.

Trans Amer. Inst. Elect. Engrs I, Vol. 79, 339-46 (1960) = Commun. and Electronics, No. 49 (July, 1960).

The Honeywell model 1500 magnetic-tape-to-paper-tape convertor is a peripheral device for the DATAmatic 1000 system and converts from 3-in. wide magnetic tape to standard 5-, 6-, 7-, or 8-level punched paper tape at a speed limited only by the punch. The conversion can be programmed according to various standard rules and it is possible for different rules to be applied to different characters in a block of information according to a programme set up on a plugboard. Various additional characters such as shifts can be inserted and there are elaborate checking procedures. The design of the transistorized circuitry is based on a number of standard packages each of which can fulfil different functions depending on how certain external connections are made. The logic of part of the circuit containing tristable devices is analysed algebraically, and it is shown how the logical equations can be used to generate wiring diagrams automatically. G.A.Montgomerie

681.142 : 621.374.5 : 539.1.07

PROPOSAL FOR AN ANALOG-TO-DIGITAL ELECTRONIC CONVERTER SUITED FOR NUCLEAR PULSE HEIGHT ANALYSIS. See Abstr. 7818

681.142 : 539.107

8488 PUNCHED TAPE READOUT FOR A MULTICHANNEL PULSE-HEIGHT ANALYZER. J.Brotzman.

Rev. sci. Instrum., Vol. 31, No. 10, 1073-6 (Oct., 1960).

An instrument for transferring information from a magnetic core memory to punched paper tape is described. When used with a 100-channel pulse-height analyser with a capacity of 10^5 counts per channel, total readout time for all 100 channels is less than 17 sec.

681.142

8489 ELECTROLUMINESCENT TYPEWRITER. T.Hamburger.

Proc. Nat. Electronics Conf., Vol. 15, 575-84 (1959).

The electroluminescent typewriter demonstrates the combined use of electroluminescence and ferroresonance in symbolic or alpha-numeric display systems. Such systems may be used: (1) to read in or read out computer information, (2) as a display board or (3) for communication between two or more remote locations. Block diagrams are given.

681.142 : 518.5

8490 INEXPENSIVE GRAPH PLOTTER FOR FIVE-TRACK PAPER TAPE. L.Molyneux and E.E.Schneider.

J. sci. Instrum., Vol. 37, No. 11, 425-31 (Nov., 1960).

The device will produce a graph from data in the form of five-track paper tape. The rate of plotting is 20 points per minute at an accuracy of up to one part in 1000. Apart from a standard ten-millivolt potentiometric recorder and tape reader, the device requires 21 transistors, 2 valves and 22 relays.

681.142

8491 HIGH-SPEED PRINTERS. W.A.J.Davie.

J. Brit. Instn Radio Engrs, Vol. 20, No. 9, 675-83 (Sept., 1960).

The distinction between serial and parallel printers and between stoppable and continuous running printers is drawn, and some of the features found in high-speed printers are discussed firstly as regards the document to be produced, and secondly as regards the inclusion of the printer in a data processing system. A comparison of on-line and off-line methods of connection follows. In the brief survey of printing principles used in high-speed printers, both mechanical and non-mechanical types are treated. A short section on checking is followed by comments on future trends in high-speed printers, including the possibility of re-entry.

681.142

8492 THE TRANSPORT OF PAPER TAPE IN DIGITAL COMPUTATION. A.D.Booth.

J. Brit. Instn Radio Engrs, Vol. 20, No. 9, 657-60 (Sept., 1960).

Using the principles of elementary dynamics limits are put on the speeds with which a paper transport mechanism which is required to stop at a given character can be expected to work. It is shown that these speeds are nearly four times those so far achieved.

681.142

8493 A HIGH-SPEED TAPE READER. R.D.Lacy.

J. Brit. Instn Radio Engrs, Vol. 20, No. 9, 661-8 (Sept., 1960).

At speeds of 1000 characters/sec, photo-electric sensing of the information is essential and the mechanical control of the tape should be as simple and as free from inertial forces as possible. An electro-magnetic brake and clutch are operated from a photo-transistor sensing the position of the sprocket hole to locate the tape in the reading positions. The action of the brake is virtually free from inertia and the tape can be stopped on any character from

the maximum speed. The functional elements, the clutch, brake and photo-sensing head have been designed to be completely interchangeable in the production models which are also fitted with adjustable guide rollers for 5, 6, 7 and 8-hole tape. The optical system permits accurate reading of tape on which the holes are incorrectly positioned relative to the edge. Functional tests show that the accuracy and reliability of the reader in service is of a very high order. Over 10^8 characters have been read from standard pattern loops without detecting an error.

681.142

8494 A NEW 600 CARDS PER MINUTE CARD READER. H.H.G.Groom.

J. Brit. Instn Radio Engrs, Vol. 20, No. 9, 669-74 (Sept., 1960).

The requirements for the machine, and their fulfilment are discussed. The card transporting mechanism, including the method of feeding individual cards, and the novel stacking unit are discussed. Two systems of card sensing are described, one using photo-transistors, the other silicon photo-voltaic cells. The results of checks of card registration and the resulting card clocking system are given. The need to replace some relay logic with faster elements is discussed and some control functions mentioned.

681.142 : 621.395.625.3

8495 "MAGNACARD" — A COMBINATION OF MAGNETIC TAPE AND PUNCHED CARDS.

Elektron. Rdsch., Vol. 14, No. 7, 283-4 (July, 1960). In German.

This information store consists of 25 × 75 mm cards magnetically coated on one side. For storage, the cards are stacked in card index cabinets: for writing or reading, they are held by suction against the cylindrical surface of rotating drums. Each card carries 17 tracks and special heads are provided for reading, writing and erasing. The mechanical devices for feeding the cards on to the drums and for subsequently stacking them are described. At a speed of 100 cards/sec, 10^5 figures/sec can be recorded, checked or erased. 3×10^8 signals can be stored in the volume of 0.33 m^3. The access time is 35 sec. H.G.M.Spratt

681.142

8496 INTRODUCTION TO TEACHING MACHINES. S.L.Levine.

I.R.E. WESCON Convention Record, Vol. 4, Pt 4, 146-9 (1960).

Introduces the subject of teaching machines. Some of the basic theory, typical operation and applications are presented. It is hoped that with this foundation, the complexities of teaching machines may be more easily comprehended.

681.142

8497 A HIGH-SPEED, ELECTRONIC ANALOG-TO-DIGITAL ENCODER. R.C.Platzek, H.F.Lewis and J.J Mielke.

Proc. Nat. Electronics Conf., Vol. 15, 182-94 (1959).

Describes a high-speed semiconductor, bi-polar analogue voltage encoder with fourteen-bit capacity. The device accepts and continuously converts voltages which are static or varying at rates not exceeding 2500 V/s. The output is a binary coded decimal equivalent of the input voltage presented for parallel readout. A general description based upon a block diagram representation of the encoder is presented including pertinent characteristics and performance specifications. The analysis of the encoder emphasizes the nature of the system error signals and the techniques used to achieve stable performance. A general discussion of routines used to extend the versatility of the device, inherent limitations, and quantitative performance data is presented.

681.142 : 518.5

8498 DIGITO-ANALOGUE COMPUTER FOR SOLVING LINEAR SIMULTANEOUS EQUATIONS AND RELATED PROBLEMS. E.V.Krishnamurthy.

J. sci. Instrum., Vol. 37, No. 11, 419-24 (Nov,, 1960).

Describes Lilavati model III, a digito-analogue computer for solving simultaneous and secular equations by a variety of iterative processes. Unlike the other computers in this field, multiplication is carried out by using Ohm's law and addition by null methods. The familiar Kelvin–Varley slide forms the basic circuit of the computer. This, in addition to simplifying the number of components involved in the computer, provides a method of feeding in and taking out the data as numbers, correct to three significant figures. An accuracy of between one and two parts in a thousand is readily obtainable.

681.142

8499 A SPECIAL PURPOSE ANALOGUE-DIGITAL CONVERTOR. G.C.Henderson.

Electronic Engng, Vol. 32, 602-8 (Oct., 1960).

The analogue-digital convertor described was developed for use in a data-processing system for the analysis of time-multiplexed telemetry records. From inputs consisting of a non-linear voltage analogue of the parameter which is being measured, a number of calibration voltages, and a train of strobe pulses, the convertor derives a binary digital output and an analogue output, both linearly related to the value, in the required units, of the parameter, with automatic correction for overall system gain and level drifts.

681.142

8500 ANALOG MULTIPLICATION USING TIME AS ONE VARIABLE. T.R.Hoffman.

Electronics, Vol. 33, No. 33, 136-8 (Aug. 12, 1960).

Transistor circuits are described in some detail, which perform multiplications by using the product of time duration and amplitude. Three forms are considered; rectangular, triangular and probability types. It is suggested that such circuits are ideally suited when one of the variables is already inherently in a time analogue; e.g. radar range. K.C.Garner

681.142

8501 ERROR ANALYSIS OF A D.C. INTEGRATOR. W.De Backer.

Ann. Assoc. Internat. Calcul Analogique, Vol. 2, No. 1, 13-23 (Jan., 1960).

A thorough theoretical analysis of factors influencing the accurate performance of integrators using operational amplifiers is given. Procedures for obtaining optimum scaling etc. are suggested, and a practical example is provided. References given cover some of the previous published work on this subject.

K.C.Garner

681.142

8502 ON THE DETERMINATION OF CERTAIN ERRORS OF ANALOG COMPUTERS. N.L.Sosenskii.

Avtomat. i Telemekh., Vol. 20, No. 10, 1381-91 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 10, 1349-58 (Oct., 1959: publ. June, 1960).

Considers the effect of nonlinearity of frequency characteristics of analogue-computer operational elements in the solution of linear differential equations with constant coefficients. To determine the errors in solution a graphicoanalytical method based on the use of the logarithmic frequency characteristics is used. An example is given of the determination of the error in solving a second-order equation for the case when the operational amplifier has a frequency characteristic of complicated form and possesses a number of parasitic elements.

681.142

8503 ON ONE METHOD OF DESIGNING TWO-INPUT ELECTRONIC FUNCTION GENERATORS. V.B.Smolov.

Avtomat. i Telemekh., Vol. 20, No. 10, 1374-80 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 10, 1342-8 (Oct., 1959: publ. June, 1960).

Deals with function-generator circuits for simulating functions of two arguments, these circuits being constructed on the basis of standard operation amplifiers with controlled impedances in the input and feedback circuits. Block schematics are given for generators to realize two-argument functions which are characteristic of standard analogue (simulation) technology.

681.142 : 621.384.6 : 537.54 : 531.5

8504 STUDY OF TWO-DIMENSIONAL NON-LINEAR OSCILLATIONS BY MEANS OF AN ELECTROMECHANICAL ANALOGUE MODEL, APPLIED TO PARTICLE MOTION IN CIRCULAR ACCELERATORS. M.Barbier and A.Schoch.

Nuclear Instrum. and Methods, Vol. 5, No. 4, 211-33 (Oct., 1959).

The apparatus consists of a flexible quartz pendulum giving a perfect harmonic oscillation. The pendulum oscillates in a vacuum and hardly any damping takes place. Its surface is rendered conducting by metallization so that electrical forces can be applied to it. If required a permanent nonlinear characteristic can be given to the pendulum by this means. It can be excited into resonance by sinusoidal forces, which may or may not depend on its instantaneous position. The properties of the apparatus and experiments made by exciting the pendulum with perturbations at a fixed frequency are

described. The performance of the machine was found to be such that one can regard it as a small calculating machine (analogue computer).

681.142 : 621-526

STUDY AND ADJUSTMENT OF A SERVOMECHANISM WITH THE AID OF AN ANALOGUE COMPUTER. See Abstr. 8421

681.142 : 621.396.677

FAR FIELD ANTENNA PATTERN CALCULATIONS BY MEANS OF A GENERAL PURPOSE ANALOG COMPUTER. See Abstr. 8231

681.142 : 621.315.23

MATHEMATICAL SOLUTION TO THE PROBLEM OF THE CONTROL OF THE THERMAL ENVIRONMENT OF BURIED CABLES. See Abstr. 7286

681.142 : 621.385.2

DETERMINATION OF PLANE, CIRCULAR AND SPHERICAL-SYMMETRICAL SPACE-CHARGE FIELDS USING A SIMPLE RESISTANCE CHAIN WITH ADDITIONAL CURRENT SOURCES. See Abstr. 7985

681.142 : 518.5 : 537.54

8505 ANALOG COMPUTER FOR CHARGED PARTICLE TRAJECTORIES. R.H.Good and O.Piccioni.
Rev. sci. Instrum., Vol. 31, No. 10, 1035-9 (Oct., 1960).

An analogue computer has been applied to the problem of tracing the trajectories of a beam of charged particles such as is produced by high-energy accelerators. The electrical circuit involved employs analogues for both quadrupole magnets and bending magnets and thus it facilitates the determination of both the focal properties and the dispersion characteristics of the magnets; an accuracy as good as 2% has been attained for some of the calculations made with the present instrument.

681.142 : 621.396.67

8506 AN ANALOGUE COMPUTER FOR AERIAL RADIATION DIAGRAMS. H.Page, G.J.Philips and J.A.S.Fox.
Rdfunktech. Mitt., Vol. 4, No. 5, 205-8 (Oct., 1960). In German.

Describes an analogue computer for determining aerial radiation diagrams for any given combination of unit elements with different orientation around a central axis. The basic elements may be fed in various ways, as far as amplitude and phase are concerned, but the diagram of the single element must be available in the form of complex numbers. The combinations must be adjusted by the user of the computer according to his experience. The machine then indicates the electrical behaviour of the arrangement, which may be improved as desired by means of further correcting modifications to the programme. The computer may be used with advantage also in the case of different orientation of the elements in respect to the aerial axis.

681.142

8507 AN ANALOGUE COMPUTER FOR AERIAL RADIATION PATTERNS. H.Page, G.J.Phillips and J.A.S.Fox.
E.B.U. Rev. A, No. 62, 146-9 (Aug., 1960).

The horizontal radiation pattern of v.h.f. aerials requires careful design to provide selective coverage of highly populated areas, with less power transmitted to lesser populated regions. This utilizes the aerial power most efficiently. A simple computer has been devised which from the known radiation pattern of a single element, computes the radiation pattern for a number of identical elements used simultaneously. Each element may have currents of different amplitudes and phases, and may be disposed in different directions relative to the supporting structure, providing the spacing from the axis is the same. The computer sets up the radiation pattern of a single element as a set of complex numbers at a set of equally spaced angular intervals. This is achieved by taking two signals from a 1 kc/s oscillator which are in 90° phase relationship and using the amplitude of the in-phase signal as a factor a_n and the quadrature signal as a factor jb_n. These are separately adjusted with potentiometers, and subsequently each complex factor is weighted by a multiplying potentiometer before the terms are added, and the total amplitude is detected on a meter which displays the modulus of the sum of all the terms for a given direction.

K.C.Garner

681.142

8508 ELAPSED TIME COMPUTATION. H.W.Abbott and V.P.Mathis.
Proc. Nat. Electronics Conf., Vol. 15, 195-201 (1959).

A number of arithmetic operations using the amplitudes of independently variable electrical quantities are considered. The variables are assumed to remain constant during the measurement interval or are appropriately sampled. To perform a division operation, for example, one variable is integrated with respect to time until the value of the integral is numerically equal to the second variable. The time required for this integration is proportional to the ratio of the two variables. A reference voltage integrated for this time is a measure of the time and therefore of the required ratio. Since both integrators operate for the same amount of time, errors due to imperfect integration will cancel provided that the two integrators have similar characteristics. Examples of semiconductor circuits employing the principles of elapsed-time computation are given. These include systems having various combinations of analogue and digital inputs and outputs. By interchanging the roles of reference voltage and input signals, the same circuits may be used for division, multiplication, squaring, and square root operations. The use of this elapsed time technique results in circuits that are simple and inexpensive, and do not require precision components. The accuracy and dynamic range are satisfactory for a wide range of applications.

681.142 : 536.48

8509 AN ANALOG SOLUTION FOR THE STATIC LONDON EQUATIONS OF SUPERCONDUCTIVITY. N.H.Meyers.
Proc. Inst. Radio Engrs, Vol. 48, No. 9, 1603-7 (Sept., 1960).

Growing interest in the theoretical as well as applied aspects of superconductivity has focused considerable attention upon the static London equations. These macroscopic relationships describe the spatial distribution of magnetic fields and currents in superconductors. A novel analogue method of obtaining solutions in complicated geometries is discussed. The method makes use of the similarity in form of the static London equations and the dynamic skin-effect equations of normal conduction under exponentially growing steady-state conditions. Conveniently scaled copper models of superconducting geometries of interest can be constructed and excited from a growing-exponential function generator. Field distributions measured in the space around the normal conductors of the model correspond with the desired distributions in the analogous superconductor geometry. Fields within conductors themselves cannot be determined directly by this method, but the surface fields are generally more important. The method is particularly useful in studying thin films which are appreciably penetrated by magnetic fields. The experimental setup and the measurement technique are discussed. Illustrative results from a copper model of a long rectangular superconducting strip, 1830 penetration depths wide and 3.81 penetration depths thick are presented.

681.142

8510 AN AUTOMATIC ANALOGUE COMPUTER FOR MISSILE-HOMING INVESTIGATIONS. J.G.Thomason.
Trans Soc. Instrum. Technol., Vol. 12, No. 1, 16-21 (March, 1960).

Missile-homing simulation is primarily a statistical problem involving the repetitive solution of a set of differential equations subject to a range of initial conditions with a stochastic forcing function, or with a varying range of coefficients. The moderately sized computer, described in general terms, is provided with punched tape reading and conversion equipment which controls the run-to-run settings of coefficients, initial conditions, timing, etc: print-out facilities are available for transmission of selected data for subsequent digital processing; if necessary. No circuit diagrams, and only brief descriptions of the conversion equipment are given. The accompanying discussion deals with the merits of operation, and some mention is made of fully automatic patching, and system synthesis as a future trend.

K.C.Garner

681.142

8511 A SERVO-TYPE ANALOGUE FOR THE SOLUTION OF SOME NON-LINEAR PROBLEMS INCLUDING THOSE INVOLVING HYSTERESIS. J.J.Bates and J.Stanway.
Instrum. Pract., Vol. 14, No. 9, 965-73 (Sept., 1960).

The analogue depends on the fact that if a motor is fed from a potential divider which carries a constant current, and is also coupled to drive the potentiometer to a lower voltage, then the motion of the wiper with time is exponential, being the solution of

a first order linear differential equation. A first order nonlinear equation is solved by varying the current supply to the potential divider with motor position, and hysteresis is introduced if this current is made dependent on the direction of motion. A plotting table displays the potential divider motion and thus the solution. By disconnecting the current supply the solution can be held. Variations in the relative speed between the plotting table and the wiper motion may also be used to introduce the nonlinearity, and to improve the performance in some cases. Example solutions are clearly described with theory and illustrations. Magnetic hysteresis is the main type of problem considered, but other physical systems may also be successfully studied by this technique. K.C.Garner

681.142 : 621-526

8512 DISCRETE ANALOGUE-COMPUTER COMPENSATION OF SAMPLED-DATA CONTROL SYSTEMS.

T.Glucharoff.

Proc. Instn Elect. Engrs, Paper 3341 M, publ. Nov., 1960, 10pp. To be republished in Vol. 108B, (1961).

Describes an analogue computer which can solve pulse transfer functions and operate as a discrete controller for compensation of sampled-data or continuous systems. Operational amplifiers and silicon-diode switches are combined to perform the basic functions of sampling, holding and time delay. The accuracy obtainable is comparable with that of digital controllers, but the analogue computer has the advantages of simplicity of setting-up and low cost. Adjustment of the controller parameters is easy, and the computer can be used to determine the coefficients of the pulse transfer function for optimum operation before a digital computer is employed. A simplified method of discrete-controller design for saturating sampled-data systems is also presented.

681.142

8513 ELECTRONIC PROGRAMME-CONTROLLED COMPUTERS. V.A.Los.

Avtomat. i Telemekh., Vol. 20, No. 4, 498-507 (1960). In Russian.

681.142

8514 AN ANALOGUE EQUIPMENT FOR SERVO-SYSTEM ANALYSIS. J.Switzman.

Engl. Elect. J., Vol. 16, No. 6, 42-50 (June, 1960).

Describes in general terms a moderate size analogue computer and its patching and monitoring arrangements. Standard techniques are used. K.C.Garner

681.142

8515 AN ANALOGUE OPTICAL SOLID ANGLE COMPUTER (OSAC).

L.J.Aldridge, L.P.Cooper, R.A.Dawkins and G.T.Winch.

G.E.C. J., Vol. 27, No. 3, 158-66 (Summer, 1960).

The computer described was designed to integrate the solid angle subtended by a body or target, in this case an aircraft model of 1/72 scale, at any distance and in any attitude between the equivalent maximum range of 200 ft, i.e., 33.3 in., and a minimum approach distance of the equivalent of 10 ft, i.e., 1.7 in. By means of an appropriate optical system, a very narrow beam of light from a special high-intensity light source is projected via a system of rotating mirrors. This light beam is directed to scan a spiral path of constant pitch, from 135° to the pole of the system. Thus the surface of an imaginary sphere, having a radius of 33.3 in., may be considered to be scanned by a "flying spot". The apparatus is operated in a darkened room with black walls and the target is painted white or coated with a glass-beaded "cats-eye" like surface and is appropriately positioned by a specially designed goniometer. When the beam of light is incident on the target, reflected light is collected onto a photomultiplier by an optical system concentric with the projection system. The photoelectric signal is amplified and shaped after which it passes to an electronic gate which controls an independently generated train of signals proportional to solid angle. This train of signals is generated by a photoelectric system which scans the surface of a polished aluminium sphere rotated in synchronism with the flying spot. The sphere carries indentations in the form of small inverted square pyramids equally spaced on a spiral path covering the whole sphere. A second gating system in series with the first limits the counting of solid-angle signals to areas falling within manually selected zonal limits θ_1 and θ_2 within the angular range $\theta = 0^\circ$ to $\theta = 135^\circ$. By means of the optical solid angle computer (OSAC), the solid angle subtended by targets equivalent to 300 ft^2 in area, at a range equivalent to 200 ft, can be can be measured to an accuracy of the order of 1 or 2%. The cycle time for the complete scan of the imaginary sphere within which the model or models will be positioned is about 1 minute. If, however, the scan is restricted to a small angular zone the scan time is proportionally less.

681.142 : 621-52

8516 ANALOGUE STUDY OF A DENSITY REGULATING SYSTEM IN A HYDROMETALLURGICAL PROCESS.

A.Herrent.

Ann. Assoc. Internat. Calcul Analogique, Vol. 11, No. 3, 112-21 (July, 1960). In French.

An automatic system designed to maintain constant the density of a pulp obtained by dilution of mineral concentrates in an acidic solution is analyzed by means of an electronic analogue computer. The density is measured indirectly by load cells placed underneath a storage tank and it is controlled by a mixing valve. The system and its controller are represented in a conventional manner. The valve actuator, however, behaves in a non-linear manner as it is fitted with stops. These stops are represented by limiting diodes and potential sources connected in parallel with the feedback resistor of the relevant computer amplifier. Measurements made on the system as originally designed revealed an excessive static error and poor regulation speed. An additional anticipatory control was introduced in the computer set up and proved to be satisfactory. A.S.Hay

681.142

8517 TRANSFER-FUNCTION MANIPULATION MAY EASE SIMULATION. I. F.Walker.

Control, Vol. 3, 100-4 (July); 113-17 (Aug., 1960).

An instructive discussion showing how, by block diagram manipulation and with standard networks, considerable economies may be obtained in the number of operational amplifiers used for a given simulation. It is pointed out that access to some of the variables may be lost. Many well-illustrated examples are given. K.C.Garner

681.142

8518 DETERMINING TRANSFER-FUNCTIONS WITH ANALOG COMPUTERS. J.H.Milsum.

I.S.A. J., Vol. 7, No. 4, 54-7 (April, 1960).

The method described consists of matching the transient response of a real system with that of a simulator network. The real system response is stored in the form of an opaque mask, fitted to the face of a c.r.t. The simulator output is repetitively traced across the c.r.t. and coefficient adjustments are made until an adequate fit occurs. Accuracies of 1% are considered attainable. The operation only takes a few minutes for relatively simple systems. Some examples are quoted. K.C.Garner

681.142

8519 ANALYTICAL SOLUTION OF DIFFERENTIAL EQUATIONS WITH THE USE OF DIFFERENTIAL ANALYSER. J.Petrich and P.Madich.

Ann. Assoc. Internat. Calcul. Analogique, Vol. 11, No. 3, 122-6 (July, 1960).

A procedure is described for setting up an analogue computer to represent a homogeneous differential equation in such a way that, by simple adjustments, the zeros of the characteristic polynomial are determined. Using transformation methods certain other classes of differential equations are amenable to this method of solution. The results of practical cases are compared with analogue solutions and exact methods, indicating the magnitude of the errors. Three worked examples are presented. K.C.Garner

681.142

8520 INVESTIGATION OF ALGEBRAIC EQUATIONS USING ANALOGUE COMPUTERS. V.M.El'yasberg.

Avtomat. i Telemekh., Vol. 20, No. 6, 756-61 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 6, 733-8 (June, 1959: publ. Feb., 1960).

A simple method is presented for the investigation of algebraic equations on analogue computers, the method being based on the reproduction of the given polynomial as the solution of the differential equation defining it. The method permits the immediate determination of the real and imaginary roots of algebraic equations, the approximate estimation of the value of their complex roots, and also the investigation of dynamic systems for stability, using the Mikhailov criterion.

681.142

8521 **A DEVICE FOR SOLVING HIGH-ORDER ALGEBRAIC EQUATIONS.** I.Kryzhe.
Avtomat. i Telemekh., Vol. 20, No. 6, 762-72 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 6, 739-48 (June, 1959: publ. Feb., 1960).

Describes a high-speed, completely automatic device for simulating algebraic polynomials and solving high-order equations. The device is constructed on a new principle, and does not contain thermionic tubes in the simulating (analogue) portion, thus removing the basic source of errors.

681.142

8522 **METHODS OF ANALOGUE COMPUTER SOLUTION OF LINEAR DIFFERENTIAL EQUATIONS WITH VARIABLE COEFFICIENTS.** I.Matyash.
Avtomat. i Telemekh., Vol. 20, No. 7, 839-47 (1959). In Russian. English translation in: Automat. Remote Control, Vol. 20, No. 7, 813-21 (July, 1959; publ. March, 1960).

Two methods are described for the solution of linear differential equations, with variable coefficients, by means of analogue computers. The methods are illustrated by examples.

681.142

8523 **THE EXACT REPRESENTATION OF IMPEDANCES ON THE RESISTANCE NETWORK ANALYSER.** J.Mills.
Instn Engrs, Austral., elect. mech. Engng Trans, Vol. EM1, No. 2, 61-8 (Nov., 1959).

Describes the application of a simple transformer computer to a method proposed by Hahn (1931) for the exact representation of impedances on a resistance network analyser. The method requires a systematic relaxation process, and the computer, which is fed directly from the analyser, solves the relaxation equations. This greatly increases the speed of the original method.

681.142 : 621.389

8524 **THE PERCEPTRON — AN EXPERIMENT IN LEARNING.** W.E.Bushor.
Electronics, Vol. 33, No. 30, 56-9 (July 22, 1960).

Describes an experimental non-digital self-organizing minimally restrained artificial nerve network which simulates an elementary mammalian visual system. The machine is capable of being trained to automatically identify objects or patterns. Basically an electronic-electromechanical device, the Perceptron consists of photocell sensory units which view the patterns, association units which contain the machine's memory response units which visually display the pattern recognition responses. The machine's recognition is direct and almost instantaneous since its memory is in the form of altered pathways through system rather than a coded representation of the unique stimuli. Experimental learning curves, the effect of noise and the performance under damage conditions are discussed. D.J.Truslove

681.142

8525 **A PARALLEL ANALOGUE READING MACHINE.** W.K.Taylor.
Control, Vol. 3, 95-9 (July, 1960).

This character recognition machine surveys the printed or written character by a matrix of photomultiplier cells, the outputs of which are compared with predetermined voltages generated according to a range of slightly or significantly different possible forms of character. A "best-match" is thus achieved. The circuits and general layout of the system are outlined and some refinements described. One of these is the "detail filter", which permits the discarding of general background trends in favour of the detailed information from the character. A 10 × 10 photomultiplier matrix has proved to be reliable in the recognition of printed alpha-numeric characters. G.H.Stearman

MECHANICAL AND CIVIL ENGINEERING TECHNOLOGY

621.9

8526 **SPARK ERODED SURFACE CHARACTERISTICS.** S.R.Ghabrial.
Engineering (London), Vol. 190, 198-9 (Aug. 5, 1960).

For various rates of spark erosion on a 2 kW machine the surface finish was determined with both a Talysurf and a Perth-o-Meter after removing various depths of metal by lapping. The amount of hand or machine correction can thus be assessed which is necessary to impart a given degree of finish to a spark-eroded surface. G.A.Montgomerie

622.2

8527 **RECENT DEVELOPMENTS AND APPLICATIONS OF ELECTRICITY AND ELECTRONICS IN THE MINING INDUSTRIES.** Y. de Wasseige.
Bull. Sci. Assoc. Ingen. Montefiore (A.I.M.), Vol. 73, No. 4, 221-58 (April, 1960). In French.

Deals in outline with some recent developments, namely: remote control of motors driving conveyor belts from any point along the belt by pressure-sensitive cables; automatic shutting down of conveyor belts in series to avoid coal piling up; automatic control of auxiliary drives by direct drive from the belt itself; automatic recording and derivation of control signals from the outputs of strain gauges. Battery locomotives; signalling systems for underground railways; switches actuated by permanent magnets (any type of switching possible by choice of interacting fields - high powers handled after transistor or magnetic amplification); automatic registration of cages and loading of tubs; centralized data-handling installations of various types; two-way telephonic communication with cages and underground using induced fields or radio for shorter distances (including one example where the main hoisting cable is used); closed circuit television, including a bore-hole camera; automatic methane-level recording. 15 references. W.D.Gilmour

MATERIALS . TESTING

620.172.2 : 621.317.39 : 539.23 : 531.78

8528 **VARIATION OF RESISTANCE OF A THIN METAL LAYER DEPOSITED ON A DEFORMABLE SUBSTRATE.** A.Colombani, B.Laniepce and P.Huet.
C.R. Acad. Sci. (Paris), Vol. 250, No. 24, 3946-8 (June 13, 1960). In French.

Bismuth films were deposited on mica or perspex substrates. The substrate was deformed by clamping it at one end and displacing the other end. The resistance of a film was observed with a bridge circuit, using a second evaporated film for temperature compensation. The resistance changes were proportional to the strain, and the coefficient of proportionality (k) for films on mica had a maximum value of 26 at a film thickness of 1000A, compared with a value of 2 for bulk material. The films on perspex were not as sensitive to strain, and for these k had a maximum value of 8. Such films were used successfully as displacement transducers. C.Hilsum

620.172.222 : 621.317.39

TEMPERATURE COMPENSATED STRAIN GAUGES. See Abstr. 6658

620.172.222 : 621.317.39

DEVELOPMENT OF HIGH-TEMPERATURE STRAIN GAUGES. See Abstr. 6657

620.172.222

8529 **MEASURING STRAIN TO 1000° F.** R.L.Hannah and A.M.Kinan.
Instrum. Control Syst., Vol. 33, No. 7, 1166-8 (July, 1960).

The dimensional changes occurring in a resistance strain gauge due to rise of temperature produce similar effects on its readings to an increase of strain. To compensate for this, a thermocouple is connected in the bridge circuit so that its e.m.f. opposes that resulting from the temperature effect. The thermo-

couple is spot welded to the flange of the gauge and wired into the output circuit, or it can be used as an integral part of the conventional three-wire circuit. A.C.Whiffin

620.178.3

8530 INVESTIGATION OF VIBRATIONS IN MACHINE CONSTRUCTION. K.Loffler.
Elektronik, Vol. 9, No. 6, 179-82 (June, 1960). In German.

620.179.1

8531 THE PRODUCTION OF VERY SHORT ULTRASONIC PULSES WITH PIEZOELECTRIC VIBRATORS.
J.Koppelmann, R.Frielinghaus and J.Meyer.
Acustica, Vol. 8, No. 4, 181-7 (1958). In German.

Use of the thickness vibrations of barium titanate vibrators for producing very short pulses is discussed, and the results of an experimental investigation given. The measuring arrangement used comprised a pulse generator producing rectangular or ringing pulses with a pulse repetition frequency of ~500 c/s which were applied to a 100 W pulse amplifier. The barium titanate transducer had a diam. of 75 mm, and a (thickness) resonant frequency of 200, 400 or 800 kc/s. The test samples were of steel or Plexiglas. The receiver consisted of a barium titanate transducer with a resonant frequency of 2 or 5 Mc/s, and its output signal was applied through an amplifier to a c.r. oscilloscope the time base of which was triggered by the pulse generator. Suitable damping was provided for both transducers. Five different output coupling circuits are given for the pulse amplifier; these produce in the transducer the following: (1) a step pulse; (2) a rounded step pulse; (3) a rectangular pulse; (4) a ringing pulse; (5) a single sine wave. A second measuring arrangement described used an echo pulse method in which a single transducer functioned as both transmitter and receiver. C.F.Pizzey

620.179.14

8532 A THROUGH TRANSMISSION SYSTEM USING PULSED EDDY CURRENT FIELDS. C.J.Renken.
Nondestr. Test., Vol. 18, No. 4, 334-6 (July-Aug., 1960).

In the through transmission technique of eddy current testing, the transmitting and receiving coils are placed on opposite sides of the material under test. A thyratron circuit generates a half-sine wave current pulse in the transmitting coil wound on $\frac{1}{4}$ in. ferrite core having an axial length of $\frac{1}{4}$ in. Peak pulsed power is about 1 kW, the pulse repetition frequency is 800 c/s, and the sine wave frequency is about 1 Mc/s. The transmitting core is surrounded by a copper mask having a small aperture in the end near the test piece, the coil being off-centre with respect to this aperture to ensure energy flow through the mask. The small hole through the mask gives good resolution, but its optimum design is still being investigated. The pulsed field enters the metal and some time later the signal emerges from the other side where it is picked up by the receiving coil which supplies a voltage to a pen recorder associated with a rectifying circuit. Reduction of signal strength occurs when there are flaws in the metal being studied. A.C.Whiffin

620.193.85

8533 ATTACK BY DRAGONFLY LARVAE ON STEEL STRUCTURES AND METHODS OF PREVENTING IT.
H.Alén.
Kraft o. Ljus, Vol. 33, No. 7-8, 155-8 (July-Aug., 1960).
In Swedish.

Rusting of underwater parts of Finnish hydro-electric station steel buildings was observed. The rust took the form of spots of 10-30 mm dia. Larvae of the dragonfly Trichoptera were found responsible, the corrosion being brought about by the prevention of free circulation of acid beneath the nests built by the larvae on the steel surfaces. Various protective paints were tested, lead paints proving generally unsatisfactory, but more promising results were obtained using synthetic paints together with zinc spraying and varnishing. Best results on pressure tubes were achieved with a 3 mm thick mechanically applied hot asphalt surfacing. C.N.J.Beck

620.197 : 621.315.2

8534 THE EFFECT OF ELECTRICAL GROUNDING SYSTEMS ON UNDERGROUND CORROSION AND CATHODIC PROTECTION. B.Husock.
Trans Amer. Inst. Elect. Engrs II, Vol. 79, 5-10 (1960) = Applic. and Industr., No. 47 (March, 1960).

Copper is the normal conductor used in grounding plant metal structures. A bimetallic corrosion effect is set up between copper and less noble metals. The factors determining the seriousness of corrosion on underground structures resulting from these systems are discussed and the basic requirements for cathodic protection are given together with a practical example. Consideration of other grounding systems than copper is called for, such as graphite, steel or zinc depending upon conditions arising, and for liaison between the designers of the electrical and mechanical portions of a plant to avoid built-in corrosion problems. W.A.Walker

WELDING . SOLDERING

621.791

8535 WELDING PROBLEMS ASSOCIATED WITH NUCLEAR FUEL ELEMENTS. A.F.Taylor.
Brit. Weld. J., Vol. 7, No. 10, 615-22 (Oct., 1959).

Considers the problems associated with the development of welding techniques for sealing present and future elements to a stage where an automatic process can be used on a production scale. The end seal is not the only application of welding in fuel element manufacture, as attachments and supports or the fuel itself also demand welds of high integrity.

621.791.75

8536 AN ANALYSIS OF TRANSFER IN GAS-SHIELDED WELDING ARCS. W.G.Greene.
Trans Amer. Inst. Elect. Engrs II, Vol. 49, 194-203 (1960) = Applic. and Industr., No. 49 (July, 1960).

The theory is presented in three sections. The first section is limited to the formation and transfer of drops under the influence of gravitational forces and surface tension alone. In the second section the formation and transfer of weightless drops under the action of surface tension and arc forces is considered. The third section deals with all three forces. Here terms are collected into dimensionless groups, one being the "transfer number" which indicates whether transfer in the arc is acceptable and by which transition currents and maximum and zero repulsion currents may be located. The other dimensionless parameter is called "drop size index" by which the size of the drops in the various regions can be estimated. For satisfactory welding the transfer number should lie between 0.01 and 1. A preliminary result of the investigation is the conclusion that deterioration in transfer under certain conditions can be attributed to excessive current density at the electrode surface. Further research on the lines indicated is advocated. R.Neumann

621.791.76

8537 USING VOLTAGE SPIKES IN RESISTANCE WELDING. S.C.Rockafellow.
Electronics, Vol. 33, No. 30, 69-71 (July 22, 1960).

A pulse power system based on a circuit comprising phase-shift equipment with thyratrons controlling the firing of ignitron tubes. A capacitor in series with a welding transformer produces voltage peaks of up to four times line voltage. The baffled coaxial ignitron passes a high current. The spike power circuit automatically raises the voltage multiplication factor as the amount of metal in the secondary circuit is increased. The transformers have very little core material so as to keep the inductance down. The method of amplifying the voltage to give the power gain ensures that the current remains within the rating of the components. Typical applications include welding, plating, metal reduction, induction heating, and motor drives. J.Smuts

LIST OF JOURNALS

The following list supplements the List of Journals published with the Index to Volume 62 (1959). Reprints of the List of Journals can be obtained from The Institution of Electrical Engineers, Savoy Place, London, W.C.2, price 2s.0d. post free. The addresses given are believed to be correct at the date of publication, but no responsibility can be accepted for errors.

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I.R.E. internat. Convention Record	I.R.E. International Convention Record (Formerly: I.R.E. National Convention Record). Institute of Radio Engineers, 1 East 79th Street, New York 21, N.Y.
Kumamoto J. Sci. A	Kumamoto Journal of Science. Series A (Mathematics, Physics and Chemistry). Faculty of Science, Kumamoto University, Kumamoto.
State Inst. Tech. Res. Rep. (Finland)	State Institute for Technical Research. Reports. Series II (Metal and Electricity). Lönnrotinkatu 37, Helsinki.

CHANGE OF TITLE

I.R.E. Nat. Convention Record	I.R.E. National Convention Record Title changed to: I.R.E. International Convention Record (I.R.E. internat. Convention Record) with Vol. 8, 1960.

ERRATA

Author Index (1959) p. 836, col. 1: for "Wollener,A." read "Wollenek,A."
Abstr. 4449 (1959) line 3: for "A.Wollener" read "A.Wollenek"
Abstr. 269 (1960): for title as printed substitute "MONOTONIC MULTI-SECTION TAPERS FOR OVER-MODED CIRCULAR WAVEGUIDES"
Abstr. 4220 (1960) line 3: for "H.Guilion" read "H.Guilion"
Abstr. 4453 (1960) line 15: for "Z.F.Zoyner" read "Z.F.Voyner"
Abstr. 4642 (1960) line 3: for "H.Fishher" read "H.Fischer"
Abstr. 6649 (1960) line 3: for "vables" read "cables"
Abstr. 6670 (1960) line 3: for "No. 2" read "No. 3"
Abstr. 6876 (1960) line 3: for "Vol. EM-7" read "Vol. ME-7"
Abstr. 7294 (1960) line 1: for "IF THE PROPERTIES" read "OF THE PROPERTIES"
line 7: for "intermediate frames" read "indeterminate frames"

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